An exciting hobby.... for everyone

everyday electronics

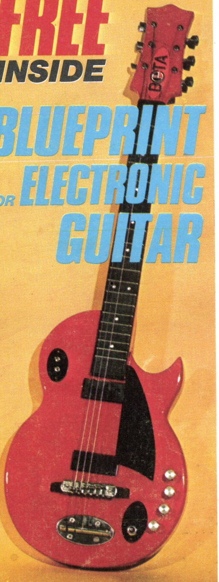
NOV 72

15p

FOR 40
Toorak Village
Newsagency

FREE INSIDE

BLUEPRINT FOR ELECTRONIC GUITAR



Australia 40c
New Zealand 40c
South Africa 40c
Rhodesia 40c
East Africa 3/50
West Africa 3/6d
Sweden Kr. 3.00

AUTO ACCELEROMETER

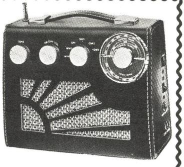
New BEGINNERS SERIES

BASIC ELECTRICITY

TRANSISTOR TESTER

Build yourself a TRANSISTOR RADIO

NEW! ROAMER 10 WITH VHF INCLUDING AIRCRAFT



10 TRANSISTORS. 9 TUNABLE WAVEBANDS, MW1, MW2, LW, SW1, SW2, SW3, TRAWLER BAND. VHF AND LOCAL STATIONS ALSO AIRCRAFT BAND

Built in Ferrite Rod Aerial for MW/LW. Retractable, chrome plated Telescopic Aerial, for peak short wave and VHF listening. Push Pull output using 600mw Transistors. Car Aerial and Tape Record Sockets. 10 Transistors plus 3 Diodes. Fine tone moving coil speaker. Air Spaced ganged Tuning Condenser with VHF section. Separate coil for Aircraft Band. Volume on/off. Wave Change and tone Control. Attractive Case in black with silver blocking. Size 9″ × 7″ × 4″. Easy to follow instructions and diagrams. Parts price list and easy build plans **30p** (FREE with parts). Earpiece with plug and switched socket for private listening **30p** extra.

Total building cost £8·50
P. P. & Ins. 50p
(Overseas P. & P. £1)

ROAMER EIGHT Mk I

NOW WITH VARIABLE TONE CONTROL

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Built in Ferrite Rod Aerial for MW and LW. Retractable chrome plated Telescopic aerial for Short Waves. Push pull output using 600mW transistors. Car aerial and Tape record sockets. Selectivity switch. Switched earpiece socket complete with earpiece. 8 transistors plus 3 diodes. Fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning, wave change and tone controls. Attractive case in rich chestnut shade with gold blocking. Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts Price List and Easy Build Plans **25p** (FREE with parts).

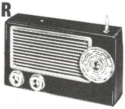
Total building cost £6·98 P. P. & Ins. 45p.
Overseas P. & P. £1)

ROAMER SEVEN MK IV

7 Tunable Wavebands: MW1, MW2, LW, SW1, SW2, SW3 and Trawler Band. Extra Medium waveband provides easier tuning of Radio Luxembourg, etc. Built in ferrite rod aerial for MW and LW. Retractable 4 section 24in. chrome plated telescopic aerial for SW. Socket for Car Aerial. Powerful push-pull output. 7 transistors and 2 diodes, fine tone moving coil speaker. Air spaced ganged tuning condenser. Volume/on/off, tuning and wave change controls. Attractive case with carrying handle Size 9 × 7 × 4in. approx. Easy to follow instructions and diagrams. Parts price list and easy build plans **15p** (FREE with parts).

Total building costs £5·98 P. P. & Ins. 45p.
(Overseas P. & P. £1)

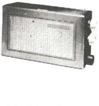
ROAMER SIX



6 Tunable Wavebands: MW, LW, SW1, SW2, Trawler band plus an extra M.W. band for easier tuning of Luxembourg etc. Sensitive ferrite rod aerial and telescopic aerial for Short Waves. 3in. Speaker. 8 stages—6 transistors and 2 diodes Attractive black. case with red grille, dial and black knobs with polished metal inserts. Size 9 × 5¼ × 2⅜in. approx. Easy build plans and parts price list 15p (FREE with parts).

Total building costs £3·98 P. P. & Ins. 30p
(Overseas P. & P. £1)

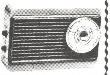
POCKET FIVE



3 Tunable Wavebands: MW, LW, Trawler Band with extended M.W. band for easier tuning of Luxembourg, etc. 7 stages—5 transistors and 2 diodes, supersensitive ferrite rod aerial, fine tone moving coil speaker. Attractive black and gold case. Size 5½ × 1½ × 3½in. Easy build plans and parts price list **10p** (FREE with parts).

Total building costs £2·29 P. P. & Ins. 21p
(Overseas P. & P. 63p)

TRANSONA FIVE

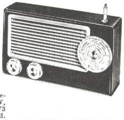


5 TRANSISTORS AND 2 DIODES

3 Tunable Wavebands: MW, LW and Trawler Band. 7 stage—5 transistors and 2 diodes, ferrite rod aerial. tuning condenser volume control, fine tone moving coil speaker. Attractive case with red speaker grille. Size 6½ × 4½ × 1¼in. Easy build plans and parts price list **10p** (FREE with parts).

Total building costs £2·50 P. P. & Ins. 24p
(Overseas P. & P. 63p)

TRANS EIGHT

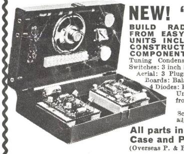


8 TRANSISTORS and 3 DIODES

6 Tunable Wavebands: MW, LW, SW1, SW2, SW3 and Trawler Band. Sensitive ferrite rod aerial for M.W. and L.W. Telescopic aerial for Short Waves. 3in. Speaker. 8 improved type transistors plus 3 diodes. Attractive case in black with red grille, dial and black knobs with polished metal inserts. Size 9 × 5¼ × 2⅜in. approx. Push pull output. Battery economiser switch for extended battery life. Ample power to drive a larger speaker. Parts price list and easy build plans **25p** (FREE with parts).

Total building costs £4·48 P. P. & Ins. 32p
(Overseas P. & P. £1)

NEW! "EDU-KIT"



BUILD RADIOS, AMPLIFIERS, ETC., FROM EASY STAGE DIAGRAMS. FIVE UNITS INCLUDING MASTER UNIT TO CONSTRUCT.

COMPONENTS INCLUDE:
Tuning Condenser: 2 Volume Controls: 2 Slider Switches: 3 inch Speaker: Terminal Strip: Ferrite Rod Aerial: 3 Plugs and Sockets: Battery Clips: 4 Tag Boards: Balanced Armature Unit: 10 Transistors: 4 Diodes: Resistors: Capacitors: Three ½″ Knobs. Units once constructed are detachable from Master Unit, enabling them to be stored for future use. Ideal for Schools, Educational Authorities and all those interested in radio construction

All parts including Case and Plans £5·50 P. P. & Ins. 32p
(Overseas P. & P. £1)

FULL AFTER SALES SERVICE

- * Callers side entrance Barratts Shoe Shop
- * Open 10–1, 2.30–4.30 Mon.–Fri. 9–12 Sat.

RADIO EXCHANGE CO

61 HIGH STREET, BEDFORD. Tel. 0234 52367

I enclose £.................... please send items marked

ROAMER TEN ☐
ROAMER EIGHT ☐
TRANSONA FIVE ☐
POCKET FIVE ☐
ROAMER SEVEN ☐
TRANS EIGHT ☐
ROAMER SIX ☐
EDU-KIT ☐

Parts price list and plans for ....

Name ....

Address ....

.... (Dept. E.E.13.)

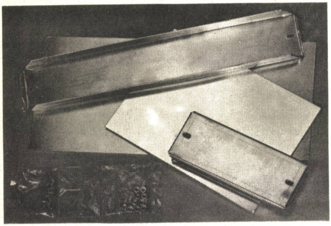
HOME RADIO (Components) LTD, Dept. EE, 234-240 London Road, Mitcham, CR4 3HD. Phone 01-648 8422

From a recent copy of "Everyday Electronics" . . .

Problems

Now to try and deal with some of the problems. We have had a number of reader's asking where the universal chassis parts that we have specified for some projects are available, the answer is Home Radio Components Ltd., who advertise their catalogue in our pages regularly.

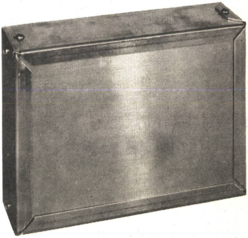
Editorial extract reproduced by kind permission of the Editor of "Everyday Electronics"



Our famous Universal Chassis, which for many years has formed the basis of thousands of radio and electronic projects, consists of a top and four separate sides. The five parts, which are made of 18 S.W.G. aluminium, can be quickly assembled with the screws provided to form a chassis even more rigid than the standard type.

The advantages of this unique chassis are:

1. **From stock, we can offer you a choice of 188 sizes, ranging from 3 x 3 x 1 ins. to 14 x 14 x 4 ins.**
2. **All parts are sold separately, so that a spoiled plate can be quickly and cheaply replaced. This is invaluable to the experimenter, who can use the same sides over and over again.**
3. **By fitting a plate to the bottom a whole range of small metal cabinets, complete with handles if required, can be assembled.**



This unique UNIVERSAL CHASSIS is obtainable ONLY from Home Radio (Components) Ltd.

A full list of plate sizes, together with reference numbers for ordering, is given in our Components Catalogue. **This famous "Constructor's Bible" lists over 8,000 components, over 1,500 of them illustrated.** It provides the quick, simple means of ordering all your component needs. Every catalogue contains 10 vouchers, each worth 5p when used as instructed. The catalogue costs 70p, including postage and packing: drop us a line or use the coupon.

POST THIS COUPON with your cheque or postal order for 70 pence

It would help us considerably if we knew whether this was your first Home Radio Components Catalogue. If it is please place a tick in the box.

Ring 01-648 8422

Ask for details of our Credit Account Service

The price of 70p applies only to catalogues purchased by customers in the U.K. and to BFPO addresses.

This is my first H.R. Components Catalogue ☐

Name ....

Address ....

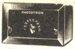
....

Home Radio (Components) Ltd.
Dept. EE, 234-240 London Road, Mitcham CR4 3HD

now *YOU* can CATCH SHOALS OF BIG FISH with new electronic miracle

special introductory offer **£2·50**

First time marketed in England, this exciting electronic instrument the "Decoytronic" is the one responsible for starting the electronic fish-lure rage in the U.S.A. just recently. Uses ingenious double-action method of attracting all kinds of fish from hundreds and hundreds of feet away . . . saltwater or freshwater. Why this device is so fantastically successful is because it *actually imitates the sound of wet insects milling about the surface.* These sound waves spread out hundreds of feet in all directions. Although this peculiar sonic frequency won't sound like much to you—to all the fish in the area it's their dinner bell! **But that's not all . . .** *electroluminescence neon tubes cunningly flicker intermittently,* penetrating the area for hundreds of feet around, at a frequency fish are unable to resist. The fish mistake this flickering glimmer for the soft phosphorescence glow given off by Plankton . . . a favourite delicacy of most fish!!! All you do is switch on, lower into the water (it's completely water resistant) allow around 5 minutes—then start reeling 'em in. We'll bet you won't be able to reel 'em in fast enough. Self-contained batteries last ages—cost pence. Kit of all parts including special easy as a.b.c. directions only **£2·50** + 25p. P. & P. (Parts available separately).



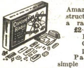
ONLY £4·50

the amazing "Phototron" SOUND OPERATED FLASH

Take flash pictures at the exact instant of the bursting of a balloon. A champagne cork leaving the bottle. The split second a hammer strikes a light bulb. *The mind boggles at the possibilities of the "Phototron" . . . the only limit is your imagination.* Now that inexpensive flash guns are on the market in quantity, it has made possible, with the help of electronics the production of a wide variety of exciting photography effects, once strictly limited to the professionals. The duration of an electronically produced flash is extremely brief and normally measured in Milliseconds. Now, providing the camera shutter is left open in a dark or subdued light, it is the timing of the flash that determines what is imprinted on the film—not necessarily anything done by the camera. As electronic flash guns are fired by making a switched connection then it becomes obvious that one of the latest Silicon Controlled Relay's can be used. If we make this S.C.R. operate by sound (with variable sensitivity control for soft/loud sounds) some real "way out" photography effects can be captured forever on film. Easily built in a coupleo f hours or so, the "Phototron" is fully solid sate, uses self contained PP3 battery. No soldering necessary using our special printed circuit terminal board (pat. Applied for). All parts including special pictorial step-by-step plans, transistors, microphone, S.C.R., potentiometers, switches, test lamp, case, nuts, screws, etc. etc., **ONLY £4·50** + 25. P. & P. *Made up must be worth at least* **£10.** (parts available separately).

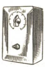
BUILD 5 RADIO AND ELECTRONIC PROJECTS

ONLY £2·45



Amazing Radio Construction set! Become a radio expert for **£2·45.** A complete Home Radio Course. No experience needed. Parts including simple instructions for each design. Illustrated step-by-step plans, all transistors, loudspeaker, personal phone, knobs, screws, etc. all you need. Presentation box **45p extra** as illus. (if required) (parts available separately) no soldering necessary. **Send £2·45** + 20p p. & p.

SOOTHE YOUR NERVES RELAX WITH THIS AMAZING RELAXATRON



ONLY £2·75

CUTS OUT NOISE POLLUTION—SOOTHES YOUR NERVES!—The RELAXATRON is basically a pink noise generator, Besides being able to mask out extraneous unwanted sounds, it has other very interesting properties. IF YOU WORK IN NOISY OR DISTRACTING SURROUNDINGS, IF YOU HAVE TROUBLE CONCENTRATING, IF YOU FEEL TENSED, UNABLE TO RELAX—then build this fantastic Relaxatron. Once used you will never want to be without it—TAKE IT ANYWHERE. Uses standard PP3 batteries (current used so small that battery life is almost shelf-life). **CAN BE EASILY BUILT BY ANYONE OVER 12 YEARS OF AGE** using our unique, step-by-step, fully illustrated plans. No soldering necessary. All parts including case, a pair of crystal phones. Components, nuts, screws, wire, etc. no soldering. **£2·75** + 25p p. & p. Parts available separately.

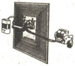
ELECTRONIC ORGAN

ONLY £3·25

Don't confuse with ordinary electronic organs that simply blow air over mouth organ type reeds etc. Fully transistorised. **SELF-CONTAINED LOUDSPEAKER.** *Fifteen separate keys span two full octaves—play the "Yellow Rose of Texas", play "Silent Night", play "Auld Lang Syne" etc.* You have the thrill and excitement of building it together with the pleasure of playing a real, live portable electronic organ. **NO PREVIOUS KNOWLEDGE OF ELECTRONICS NEEDED.** No soldering, simple as ABC to make. *Anyone over nine years can build it easily in one short evening following the fully illustrated, step-by-step, simple instructions.* **ONLY £3·25** + 25p. p. & p. for kit, including case, nuts, screws, simple instructions, etc. Uses standard battery (parts available separately). Have all the pleasure of making it yourself, finish with an exciting gift for someone.

READY BUILT AND TESTED TREASURE LOCATOR MODULE

ONLY £4·95



FULLY TRANSISTORISED PRINTED CIRCUIT METAL DETECTOR MODULE. *Ready built and tested*—just plug in a PP3 battery and phones and it's working. Put it in a case, screw a handle on and **YOU HAVE A PORTABLE TREASURE LOCATOR EASILY WORTH ABOUT £20!** Extremely sensitive—penetrates through earth, sand, rock, water, etc.—EASILY LOCATES COINS, GOLD, SILVER, JEWELLERY, HISTORICAL RELICS, BURIED PIPES, ETC. *So sensitive it will detect certain objects buried* **SEVERAL FEET BELOW GROUND!** GIVES CLEAR SIGNAL ON ONE COIN **£4·95** + 30p carr. etc.

Eavesdrop on the exciting world of Aircraft Communications— V.H.F. AIRCRAFT BAND CONVERTER ONLY £2·85

Listen in to **AIRLINES, PRIVATE PLANES, JET-PLANES.** *Eavesdrop on exciting cross talk between pilots, ground approach control, airport tower, Hear for yourself the disciplined voices hiding tenseness of talk downs.* Be with them when they have to take nerve ripping decisions in emergencies—Tune into the international distress frequency. Covers the aircraft frequency band including **HEATHROW, GATWICK, LUTON, RINGWAY, PRESTWICK, ETC. ETC. CLEAR AS A BELL.** This fantastic fully transistorised instrument can *be built by anyone over nine in under two hours.* No soldering necessary. Fully illustrated simple instructions take you step-by-step. Uses standard PP3 battery. All you do is extend rod aerial, place close to any ordinary medium wave radio (even tiny portables). **NO CONNECTIONS WHATEVER NEEDED. SEND ONLY £2·85** + 20p. p. & p. for kit including case, nuts, screws, wire, etc. etc. (parts available separately).

INGENIOUS ELECTRONIC SLEEP INDUCER

ONLY £3·25

Do you wake up in the night and can't get off to sleep again? Would you like to be gently soothed off to satisfying sleep every night? Then build this ingenious electronic sleep inducer. *It even stops by itself so you don't have to worry about it being on all night!* The loudspeaker produces soothing audio-frequency sounds, continuously repeated—but as time goes on the sound gradually becomes less and less—until they eventually cease altogether, *the effect it has on people is amazingly very similar to hypnosis.* All transistor. No knowledge of electronics or radio needed. Step-by-step instructions included. *No soldering necessary.* Kit includes case, nuts, wire, screws, etc. **SEND £3·25** + 25p p. & p. (parts available separately).

FIND BURIED TREASURE!

Transistorised Treasure Locator

ONLY £2·85

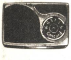
This fully portable transistorised metal locator detects and tracks down buried metal objects—it signals exact location with loud audible sound (no phones used)—uses any transistor radio which fits inside—no connections needed. **FINDS GOLD, SILVER, COINS, JEWELLERY, ARCHAEOLOGICAL PIECES ETC. ETC.** *Extremely sensitive will signal presence of certain objects buried several feet below ground.* No knowledge of radio or electronics required. *Can be built with ease in one short evening by anybody from nine years of age upwards,* with the clear, easy to follow, step-by-step, fully illustrated instructions—Uses standard PP3 battery. No soldering necessary. Kit includes nuts screws, wire, etc. **ONLY £2·85** + 25p. p. & p. (Sectional handle as illustrated **95p. extra**). Parts available separately. Made up looks worth **£15.**

SHORTWAVE TRANSISTOR RADIO

ONLY £2·75

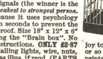
Anyone from 9 years up can follow the step by step, easy as ABC fully illustrated instructions No soldering necessary. 76 stations logged on rod aerial in 30 mins.—**RUSSIA, AFRICA, USA, SWITZERLAND,** etc. Experience thrills of world wide news, sport, music, etc. **Eavesdrop on unusual broadcasts.** Uses PP3 battery. Size only 3" x $4\frac{3}{8}$" x $1\frac{3}{8}$" **Only £2·75** + 20p p. & p. Kit includes cabinet, screws, instructions. etc. (Parts available separately.).

UNIQUE RADIO FOR BEDROOM OR OFFICE No batteries, no electricity, never wears out ONLY £1·70



Tune in your favourite programmes or the news, or sports in the Office or in your bedroom. Uses sensitive, germanium diode originally evolved from Wartime radar. Never buy a battery. Never use electricity. Never replace. Covers all medium waves. Clear beautiful tone. Size $4\frac{1}{4}$" x $2\frac{3}{4}$" x $1\frac{1}{4}$" in beautiful case. **ONLY 7 CONNECTIONS AND IT'S WORKING.** No soldering necessary. **CAN BE BUILT ALMOST BLINDFOLD IN UNDER 15 MINUTES!** Ideal for absolute beginner from 8 years of age upwards. **SPECIAL PRICE TO CLEAR STOCKS OF COMPONENTS, ONLY £1·70** + 20p. P. & P. for all parts including beautiful case. Germanium semi-conductor, tuning condenser, personal phone, wire, nuts, screws. **SIMPLE AS A.B.C. INSTRUCTIONS** (Parts available separately).

"READ PEOPLE'S MINDS"—TEST THEIR NERVES—BEAT THEM AT CARDS, ETC. WITH THIS ASTONISHING ELECTRONIC BRAIN BOX Only £2·87



With this "Brain-box" you will be able to *perform mind-boggling feats.* **THE MIND READING DEVICE** will make people swear you have "telepathic" powers. THE AMAZING CARD TRICK UNIT completely mystifies and baffles from one to six people. *You correctly "guess" the two cards each person has selected at random from a pack they themselves shuffled.* **THE ELECTRONICS NERVES TESTER** puts your friends to a very lively test. It gives out fail and finish signals (the winner is the person with lowest number of fail signals.) *Can be adjusted from the weakest to strongest person.* **THE ELECTRONIC MAZE** *tests the mental ability of the player* because it uses psychology with an electronic twist to it. You can change the maze pathways in seconds to prevent the maze becoming too stale after lots of use. Completely safe and foolproof. Size 18" x 12" x 6" (Max.). You can play all these games and more beside after building the "Brain box". No soldering, you get pictorial, easy as a.b.c. step-by-step simple instructions. **ONLY £2·87** + 33p. p. & p. for all parts including chassis, switches, stylus, signalling lights, wire, nuts, screws, etc. etc. Uses standard battery. Presentation Box 33p. extra as illus. if reqd. (PARTS AVAILABLE SEPARATELY) **FULL OPERATING DIRECTIONS WITH EACH OF THE PROJECTS.**

AMAZING MAGIC MUSIC BOX

make electronic music waving your hands about

only £2·75 Everyone's heard the weird, wonderful, but beautiful music used in Science Fiction Films, Horror Films etc., also on Radio and Television. This unearthly, eerie music is almost always produced by a little known electronic device measuring only a few inches . . . called a Theremin. All you have to do is switch on your radio (almost any type will do) and place the Theremin close by. Switch on the Theremin and proceed to wave your hands mysteriously in the air like a magician. The most fantastic musical sounds are then produced, and with a little practice people can learn to play all the well known tunes. Apart from it's musical value, it's small size allows it to be used to best advantage at parties, gatherings of friends etc., where it attracts tremendous interest. Provides hours and hours of pleasure to young and old. Uses standard PP3 battery which lasts ages. The 3 Transistor circuit, though fairly advanced is simple to build with our pictorial step-by-step plans. No soldering necessary. Easily built in an hour or so using our special printed circuit *terminal* board (Pat. Applied For). All parts including nuts, bolts, case etc., **ONLY £2·75** + 25p. P. & P. (Parts available separately.

INGENIOUS ELECTRONIC SINGING & WARBLING CANARY only £4·50

Actually whistles & warbles like a real live Canary! Amazing circuitry faithfully reproduces the Canary's magnificent song. Just switch on and leave it—whistling down scale for some seconds, suddenly breaking into a delightful warble, then several seconds later shutting off for a second or two—only to start automatically again in a few seconds. People listen to the delightful song all day and never get bored! Relax, as the sweetest nerve-soothing birdsong takes you to leafy woods and glades. Provides countless hours of joy to young and old alike. Standard self-contained battery lasts ages. Easily built in an hour or so with special pictorial step-by-step plans. No soldering necessary. All parts including printed circuit terminal board (pat. applied for) transformers, loudspeaker, transistors, nuts, screws, wire, etc. + case (which fits under cage—cage and toy bird not supplied) **ONLY £4·50** + 25p. P. & P. (parts available separately).

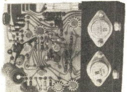
CONCORD ELECTRONICS LTD. (E.E.11) 8, Westbourne Grove, London, W.2. *Callers welcome 9 a.m.—5.30 p.m.*

SAXON ENTERTAINMENTS.

STANDARD & CUSTOM-BUILT AUDIO & ELECTRONIC EQUIPMENT NEW & SECONDHAND MUSICAL INSTRUMENTS. MAIN DISTRIBUTORS FOR A.K.G. HIGH QUALITY MICROPHONES.

SA25-SA35-SA100

LOW-PRICED AUDIO MODULES FOR DOMESTIC & COMMERCIAL USE



THESE THREE MODULES HAVE ENJOYED UNPARALLELED SUCCESS DURING THE FIRST FEW MONTHS OF THEIR BEING MADE AVAILABLE TO THE GENERAL PUBLIC. WE ARE PLEASED TO ANNOUNCE THAT WE CAN NOW OFFER FAST DISPATCH ON MOST OF OUR ADVERTISED ITEMS, INCLUDING THESE THREE MODULES.

SA25 £2·95 carr. free

25 WATTS RMS. 7 transistors 7 diodes

SA35 £4·45 carr. free

35 WATTS RMS. 7 transistors 7 diodes

SA100 £10·90 carr. free

100 WATTS RMS. 11 transistors 6 diodes

ALL THREE MODULES HAVE OPEN & SHORT CIRCUIT PROTECTION, AND THE SA100 IS PROOF AGAINST OVER-DISSIPATION & FAULTY INDUCTIVE LOADS. ONLY ADVANCED DESIGN TECHNIQUES MAKE THESE EXTRA-ORDINARILY LOW PRICES POSSIBLE.

BRIEF SPEC. FOR ALL THREE MODULES

Freq. response	15–40,000 Hz ± 1dB
Distortion	0·2% at 1 kHz
Loads	4 to 16 ohms
Quiescent current	15 mA
Noise	Better than −75 dB
Supply voltage	25–45 volts SA25/35 40–70 volts SA100
Size	4½″ x 4″ x 1″ (SA100) 4″ x 3″ x 1″ (SA25/SA35)

Circuits, connecting instruction and application data are supplied free with all modules.

POWER SUPPLIES FOR THE SA25/35 & SA100 AUDIO MODULES

Stab PS45	Stabilized module for 2 SA25's or two SA35's	£3·50 carr. free
MT45	Transformer for above, heavy duty	£2·85 carr. 20p
MT30	Transformer for unstabilized supply complete with rectifier diodes mounted	£3·50 carr. 20p
PU70	Unstabilized supply for one or two SA100	£6·75 carr. 40p
PS70	Stabilized supply module for one or two SA100's	£4·90 carr. free
MT70	Transformer for PS70	£4·90 carr. 40p

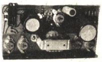
ALL MODULES ARE BUILT ON GLASS FIBRE P.C. BOARD

OTHER SAXON PRODUCTS. . .

120 WATT HEAVY DUTY MODULE

£13·90 + 20p carr. or with supply **£18·95** + 40p carr.

Featuring a rugged class A driver stage, this module will run from all our mixers, etc., and most other makes of mixer. It delivers 120 watts into an eight ohm load and employs 4 T03 can (115 watt) output transistors.



SPECIFICATION

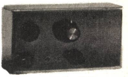
Power output	120 watts into 8 ohms
Freq. response	30-30,000 HZ ± 2dB
Input sensitivity	200 mV into 10K
Construction	Fibreglass board
Size	8″ x 4″ x 4″ (5″ with supply)

Low distortion parallel push-pull output stage.

SINGLE CHANNEL SOUND/LIGHT CONVERTER

This compact and reliable unit operates from amplifiers with outputs from 5–100 watts. Does not impose a heavy load on the amplifier, or, if connected in the wrong polarity, cause any damage, as with some units.

Operation is simplicity itself and the unit is fully fused. The unit is supplied to function from bass notes but may easily be converted to respond only to treble or mis-range notes by the addition of components costing less than 5p.



£8·90 carr. free

THREE CHANNEL SOUND TO LIGHT UNIT

Handling the total of 3000 watt (3kw) this unit is unique for its price in that not only bass, middle and treble but also master controls are provided. Two amplifier sockets eliminate the need for split leads, etc. Supplied in tough white steel case with a blue stelvetite hooded cover. Fully guaranteed.

£19·75 carr. 30p

SAXON STEREO CONTROL UNIT

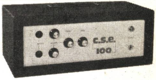
£15·80 carr. 30p

MONO VERSION
£6·50 carr. 20p

(As illustrated left S.A.E. details 9 volt operation)
Outputs up to 1 volt RMS

Two decks, and full headphone monitoring. The unit is mains operated and measures 17½″ x 3″ x 4″ deep and is finished with a smart white on black facia. The controls are: Left/Right deck fader, volume, bass, treble, Headphone Selector and volume, Microphone volume, bass, treble, mains on/off.
THIS IS A MUST FOR THE HOME BUILT HIGH QUALITY DISCOTHEQUE AND IS COMPARABLE TO UNITS AT OVER TWICE THE PRICE.

COMPLETE AMPLIFIERS



The CSE 100. £34·90 carr. free

This versatile unit is now available in a black vynide case and so represents even better value than ever delivering speech and music powers of up to 100 watts RMS and continuous sine wave outputs of 70 watts. Two individually controlled inputs with wide range bass and treble controls. Ideal for small groups D.J.S., etc.

The SAXON 100 £48·50 carr. free

With an RMS output of 120 watts speech and music, 100 watts continuous power, four individually controlled FET input stages and wide range bass and treble controls, this amplifier has established itself as a unit offering quality and reliability at low cost.

LOUDSPEAKERS British made bargains!!

12″ 25 watt 8/15 ohms **£4·95** carr. 30p. 15″ 50W.8/15 ohm **£14·50** carr. 50p.
12″ 40 watt 15,000 gauss magnet system 8/15 ohm **£11·50** carr. 40p.
A.K.G. microphones suitable for disco. group or general P.A. use.
D11DHL rrp **£11·00** our price **£9·45** post free
D190C High Z rrp **£21·50** our price **£17·45** post free
D1000C 24 ct gold plate rrp **£37·00** our price **£32·00** post free

SEND SAE FOR OUR AKG PRICE LIST. DISCOUNTS ON ALL MICS.

CALLERS & MAIL ORDER:

327-331 Whitehorse Rd.,
West Croydon, Surrey.
CRO 2HS 01-684 6385

CALLERS ONLY:

6a Delce Rd., Rochester,
Kent. Medway 404199

BUSINESS HOURS:

9.30 a.m.
to 5.30 p.m.

TERMS OF BUSINESS:

C.W.O. or C.O.D. (35p extra)
All cash in regd. envelopes please!
Telephone orders to our CROYDON BRANCH.
TRADE & EXPORT enquiries invited.

CRESCENT RADIO LTD

11 & 40 MAYES ROAD, LONDON N22 6TL 888 3206

MAIL ORDER
DEPT.
No. 11
MAYES RD.
LONDON
N22
6TL

COMPONENTS AND HI FI FOR THE HOME CONSTRUCTOR

OUR SHOPS ARE OPEN ALL DAY
FROM 9 A.M. TO 6 P.M. 6.30 P.M. ON FRIDAY
(WE CLOSE ALL DAY THURSDAY)

13 SOUTH MALL, EDMONTON, N·9 803 1685

S. G. BROWN "DIPLOMAT" MONO/STEREO. HEADSET

Finest quality British made Lightweight Headphones.
Incorporate ceramic piezo electric transducers.
Specification:—
Frequency—20–17,500 CPS.
Impedance — Predominantly capacitive, at ·001MFD per earpiece can be regarded as 150K at 1kcs.
Weight—3·5oz. (98 grams).

A Bargain at **£2·50p** each set
Please include 10p per set P.P.

"CRESCENT" DIGITAL CLOCK KIT

24 Hour Nixie Digital Clock Kit We Supply:

★ A complete set of components
★ A complete set of easy to follow instructions
★ Printed circuits made to make construction as simple as possible
★ A cabinet and front panel to give a professional finish.

All for the price of the components. **£22·50.** + 50p. P. & P.
Please send S.A.E. for more information.

BRIDGE RECTIFIER

Plastic encapsulated.
Texas Type No 1B40-K05 **50v at 4 amp**
Our Price **55p**
+ 5p P. & P.

MINIATURE RELAY

6 volt 70 ohm.
Single Pole Changeover.
Approx. size = 1¼" × 1" × ¾".

40p plus 5p P. & P.

S.G. BROWN HEADPHONES

Used! But in good working condition. These Type "F" phones are 4,000 Ω imp. and a bargain at

50p Plus 10p. P. & P. per pair

LOW VOLTAGE AMPLIFIER

Few only at **£1·75** plus 13p P. & P.

5 transistor amplifier complete with volume control, is suitable for 9V d.c. and a.c. supplies. Will give about 1W at 8 ohm output.
With high IMP input this amplifier will work as a record player, baby alarm, etc., amplifier.

LOUDSPEAKER BARGAINS

E.M.I. 450 set 3. 8. 15 ohm
£3·50 plus 38p. P. & P.
E.M.I. 350 set 8 ohm.
£7·00 plus 38p. P. & P.

MINI LOUDSPEAKERS

2¼" (57mm) 8ohm — **50p** each
2¼" (57mm) 40ohm — **50p** each
2¼" (57mm) 80ohm — **50p** each
Please include 5p. P. & P. up to 3 Mini-Loudspeakers

TRI-VOLT BATTERY ELIMINATOR

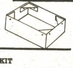
Enables you to work your transistor radio, amplifier, or cassette, etc. from A.C. mains through this compact eliminator. Just by moving a plug you can select the voltage you require — 6v, 7½v or 9 volts. This means all your transistor power pack applications can be handled by this one unit. Approx. size: 2¾" x 2¼" x 3¼". OUR PRICE — **£2·75p** + 10p. P. & P. Same model suitably wired for the Philips Cassette — **£3·00** + 10p. P. & P.

ALUMINIUM CHASSIS

Made from 18 gauge aluminium 4 sided chassis with corner brackets. All are 2½" depth.

6×3—**41p**	12×3—**53p**	14×9—**94p**
6×4—**45p**	12×5—**61p**	16×6—**86p**
8×6—**53p**	12×8—**83p**	16×10—**1·08p**
10×7—**63p**	14×3—**60p**	

Please send 10p per chassis P. & P.



2N3055 POPULAR POWER TRANSISTOR

Now at our Low Price
50p each
Please include 5p P. & P.

BARGAIN S.C.R.

TESTED THYRISTOR
400 volt. 3 amp.
45p each 5 for **£2·00**
Please include 5p P. & P.

PRINTED CIRCUIT KIT

Everything for producing your own printed circuits.
£1·40p plus 10p. P. & P.

PRINTED CIRCUIT BOARD

8×6—**10p**	10×8—**15p**
9×5—**10p**	12×12—**30p**

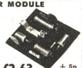
Please inc. 3p. per board P. & P.

EA1000 3 WATT AUDIO AMPLIFIER MODULE

An Audio Amplifier designed around the TAA621 Linear I.C.:—

Supply Voltage	9–24V
Speaker Imp.	8–16 ohm
Frequency	50hZ–25kHz
Overall Size	2in × 3in × ¾in

Ideal Amplifier for radios, record players, stereo units, etc.
Full technical data and diagrams with each module. All guaranteed and a bargain at **£2·63** + 5p P. & P.



TRI-VOLT CAR CONVERTER

Enables you to work your Transistor Radio, Amplifier or Cassette etc. from the 12 volt car supply positive or neg. earth.
This converter supplies 6, 7½ or 9 volts and is transistor regulated. Approx. size 2½" × 3½" × 2"
Very easy to fit and a real money saving device for **£2·50** + 10p. P. & P.

WAFER SWITCHES

1 pole 12 way
2 pole 2 way
2 pole 3 way
2 pole 4 way
2 pole 6 way
3 pole 4 way
4 pole 3 way
18p each. Please inc. 5p P. & P. Up to 3 switches.

POTENTIOMETERS

All types 1" and less diameter.

SINGLES		DUAL	
5K 10K 25K 50K 100K 250K 500K 1M 2M	**Log or Lin Less Switch 12p ea, Double Pole Switch 24p ea,**	5K 10K 25K 50K 100K 250K 500K 1M 2M	**Less Switch 40p. each**

Up to 3 Pots. Please add 5p. P. & P.

MINIATURE RELAYS

Brand new range of British made Relays.
Size—1¼" × 1" × ¾"
All two changeovers with 250V. 1·5A contacts and suitable for fitting on ·1m Veroboard.

Type	Volts	Current	Ohms.
27/A	12v	17M/A	700 Ω
21/A	12v	28M/A	430 Ω
12/A	6v	33M/A	185 Ω

80p each.
Please include 5p P & P up to 3 Relays.

C. HADLEY

24, WOODHILL, HARLOW, ESSEX

Add 5p P. & P. Price list S.A.E.
No callers please.

All our stocks are brand new with money back guarantee

TRANSISTORS

AC107	15p
AC126	11p
AC127	11p
AC128	11p
AC176	25p
AC141K	20p
AC142K	20p
AD14	40p
AD150	44p
AD161 AD162 M/P	55p
AF114	15p
AF115	15p
AF116	15p
AF117	15p
AL102	59p
AL103	49p
AU103	85p
AU111	95p
BC107	8p
BC108	8p
BC109	8p
BC154	20p
BC168	10p
BC169	11p
BC182L	8p
BC183L	8p
BC184L	8p
BC212L	8p
BC214L	8p
BD116	79p
BD121	50p
BD130	46p
BD131	59p
BF194	15p
BFY50	15p
BFY51	12p
BSY95A	15p
ME0402	18p
ME0404	14p
ME4401	10p
ME4102	12p
ME6002	14p
ME6101	14p
ME6102	15p
MP8111	32p
MP8511	34p
MP8513	45p
OC41	13p
OC14	13p
OC45	13p
OC71	12p
OC72	12p
OC81	13p
OC81D	13p
OC83	20p
OC170	24p
OC200	25p
OC201	25p
OC25	25p
OC28	30p
OC29	36p
OC35	25p
OC36	36p
TIP29A	48p
TIP30A	55p
TIP31A	58p
TIP32A	69p
TIP33A	95p
TIP34A	£1·80
2N697	18p
2N1171	24p
2N1304	25p
2N1305	25p
2N2646	47p
2N2926	10p
2N3053	20p
2N3055	49p
2N3702	12p
2N3703	12p
2N3704	12p
2N3705	12p
2N3706	10p
2N3707	10p
2N3708	9p
2N3709	10p
2N3710	10p
2N3711	10p
40251	49p
40636	55p

DIODES

1N4001	4p
1N4002	4p
1N4003	5p
1N4004	7p
OA90	6p
OA91	6p
OA200	10p
OA202	8p
1S44	10p
1N4149	4p
WO2	32p

CAPACITORS

MULLARD POLYESTER CAPACITORS C280 SERIES

250V P.C. mounting: 0·01μF, 0·015μF, 0·022μF, **3p.** 0·033μF, 0·047μF, 0·068μF, **3½p.** 0·1μF, **4p.** 0·15μF, 0·22μF, **5p.** 0·33μF, **6½p.** 0·47μF, **8½p.** 0·68μF, **11p.** 1·0μF, **13p.** 1·5μF, **20p.** 2·2μF, **24p.**

MULLARD POLYESTER CAPACITORS C296 SERIES

400V: 0·001μF, 0·0015μF, 0·0022μF, 0·0033μF, 0·0047μF, **2½p.** 0·0068μF, 0·01μF, 0·015μF, 0·022μF, 0·033μF, **3p.** 0·047μF, 0·068μF, 0·1μF, **4p.** 0·15μF, **6p.** 0·22μF, **7½p.** 0·33μF, **11p.** 0·47μF, **13p.**
160V: 0·01μF, 0·015μF, 0·022μF, 0·033μF, 0·047μF, 0·068μF, **3p.** 0·1μF, **3½p.** 0·15μF, **4½p.** 0·22μF, **5p.** 0·33μF, **6p.** 0·47μF, **7½p.** 0·68μF, **11p.** 1·0μF, **13p.**

ELECTROLYTIC CAPACITORS—MULLARD C426 SERIES **6p each**

(μF/V) 10/2·5, 20/2·5, 80/2·5, 160/2·5, 320/2·5, 500/2·5, 8/4, 32/4, 64/4, 125/4, 250/4, 400/4, 6·4/6·4, 25/6·4, 50/6·4, 100/6·4, 200/6·4, 320/6·4, 4/10, 16/10, 32/10, 64/10, 125/10, 200/10, 2·5/16, 10/16, 20/16, 40/16, 80/16, 125/16, 1·6/25, 6·4/25, 12·5/25, 25/25, 50/25, 80/25, 1/40, 4/40, 8/40, 16/40, 32/40, 50/40, 0·64/64, 2·5/64, 5/64, 10/64, 20/64, 32/64.

MULLARD C437 SERIES

100/40, 160/25, 250/16, 400/10, 640/6·4, 800/4, 1000/2·5, **9p.** 100/64, 160/40, 250/25, 400/16, 640/10, 1250/4, 1000/6·4, 1600/2·5, **12p.** 160/64, 250/40, 400/2·5, 640/16, 2000/4, 1000/10, 1600/6·4, 2500/2·5, **15p.** 250/64, 400/40, 640/25, 3200/4, 1000/16, 1600/10, 2500/6·4, 4000/2·5, **18p.**

Miniature Fixed Ceramic Plate, **3p** each.
Preferred values from 1·8pf to 10,000pf.

MINITRON DIGITAL INDICATOR TYPE 3015F

Reads 0–9 and decimals
(Data Sheet on request)

ONLY £1·50
for one month only

16 DIL Socket **30p**
Driven by 7447 **95p**

SUPER LOW PRICED LINEAR I.C'S

301A	To99	49p
301A	DIL	45p
709C	To99	28p
709C	DIL	30p
723C	To99	87p
723C	DIL	90p
741C	To99	35p
741C	DIL	34p
741C	8p in DIL	34p
747C	DIL	40p
748C	To99	38p

VOLUME CONTROLS

Potentiometers
Carbon track 500 Ω to 2·2M Ω
Log or Linear
Single **12p.** Dual gang (stereo) **40p.**
Single type only with D.P. Switch **12p** extra.

RESISTORS

¼ watt 5% carbon **1p each**
½ watt 10% carbon **1p each**
range 2·7 Ω to 10M Ω type TR5 triple rated ⅛–¼–½, tin oxide × 2% range 10 Ω to 1M Ω. **3p each**

SLIDE SWITCH

SPST **10p each**
SP Three Position **12p each**

MINIATURE NEON LAMPS

240v or 110v 1–4 **5p,** 5 plus **4½p** each.

CARBON SKELETON PRE-SETS

Small high quality, type PR, linear only: 100 Ω, 220 Ω, 470 Ω, 1K, 2K2, 4K7, 10K, 22K, 47K, 100K, 220K, 470K, 1M, 2M2, 4M7, 10M Ω. Vertical or horizontal mounting, **5p each.**

VEROBOARD

	0·15 Matrix	0·1 Matrix
2½ × 3¾in	17p	23p
2½ × 5in	25p	25p
3¾ × 3¾in	25p	25p
3¾ × 5in	30p	29p
5 × 17in (Plain)	83p	—

Vero Pins (Bag of 36) **20p.**
Vero Cutter **45p.**
Pin Insertion Tools (·1 and ·15 matrix) at **55p.**

ZENER DIODES

400mW 5% 3·3V to 30V, **15p.**

LOW COST DUAL INLINE I.C. SOCKETS

14 pin type at **15p** each.
16 pin type at **16p** each.

TRANSISTOR EQUIVALENTS BOOK **40p**

Pack of 20
1N4148 **50p**

AC127 & AC128
1–9 **13p**
10 plus **11p**
100 plus **9p**

2N3055
1–9 **49p**
10 plus **46p**

Pack of 10
2N2926G **50p**
unbranded but tested

Unmarked but fully tested
2N3055
1–9 **30p**
10 plus **25p**

Mix Pack of 20
1N4000
Series Diodes **50p**

AD161, AD162
M/P
1–9 **52p**
10 plus **48p**

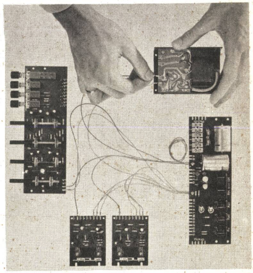
BC107–BC108
BC109
1–9 **8p**
10–99 **7p**
100 plus **6p**

Pack of 10
Plastic BC109 **50p**
Unmarked but fully tested

TBA800
5 watt AF power Amp. **£1·40 each**

Project 605 the new simple way to assemble Sinclair high fidelity modules

Sinclair Project 605 Amplifier
30 watt hi-fi stereo modular amplifier complete & ready to assemble using the new Masterlink connector unit
No soldering
Sinclair Project 605 Amplifier
A complete high fidelity amplifier for the home constructor



For several years now you have been able to assemble your own high fidelity system to world beating standards using Sinclair modules. We have progressively improved these technically but hitherto the method of assembly at your end has remained the same – there has been no alternative to a soldering iron. Now for those who prefer not to solder, there is an alternative – Project 605.

In one neat package you can now obtain the four basic Project 60 modules plus a fifth completely new one – Masterlink – which contains all the input sockets and output components you previously bought separately. Also in the Project 605 pack are all the inter-connecting leads, cut to length and fitted at each end with plugs which clip straight onto the modules, eliminating soldering completely. The pack contains everything you need to build a complete 30 watt stereo amplifier together with a clear well illustrated Instruction Book. All you have to do is to arrange your modules in the plinth or case of your choice and then clip them together – the work of a few minutes.

Your hi-fi system will, as we said, match the finest in the world and you can add to it at any time to increase power or extend the facilities. For example a superb stereo FM Tuner unit is obtainable for only £25.

Guarantee If within 3 months of purchasing Project 605 directly from us, you are dissatisfied with it, we will refund your money at once. Each module is guaranteed to work perfectly and should any defect arise in normal use we will service it at once and without any cost to you whatsoever provided that it is returned to us within 2 years of the purchase date. There will be a small charge for service thereafter. No charge for postage by surface mail, Air-mail charged at cost.

sinclair

Sinclair Radionics Ltd., London Road.,
St. Ives, Huntingdonshire PE17 4HJ.
Telephone: St. Ives (04806) 4311

Specifications

Output – 30 watts music power (10 watts per channel R.M.S. into 3 Ω).

Inputs – Mag. P.U. – 3mV correct to R.I.A.A. curve 20–25,000 Hz ± 1dB. Ceramic pick-up – 50mV. Radio – 50 to 150mV. Aux. adjustable between 3mV. and 3V.

Signal to noise ratio – Better than 70dB.

Distortion – better than 0.2% under all conditions.

Controls – Press buttons for on-off, P.U., radio and aux. Treble +15 to —15 dB at 10 kHz. Bass +15 to —15 dB at 100 Hz. Volume. Stereo Balance.

Channel matching within 1dB.

Front panel – brushed aluminium with black knobs.

Project 605 comprises Stereo 60 pre-amp/control unit, two Z-30 power amplifiers, PZ-5 power supply unit, the unique new Masterlink, leads and instructions manual complete in one pack. Post free

£29.95

To SINCLAIR RADIONICS LTD., ST. IVES, HUNTINGDONSHIRE PE17 4HJ

Please send Project 605 post free ☐ Details and list of stockists ☐

Name ....

Address ....

....

for which I enclose £29.95 cheque/money order/cash. **E.E.98.**

DISCOUNTS UP TO

60%

Global's GOLDEN **Guarantee**

WE GUARANTEE THAT WITHIN 7 DAYS OF PURCHASE IF ANY ITEM OF GOODS IS FOUND TO BE **GENUINELY** DEFECTIVE WE WILL REPLACE THE SAID GOODS WITHOUT QUESTION. AFTER 7 DAYS GOODS ARE COVERED BY MANUFACTURERS 12 MONTHS GUARANTEE.

GARRARD SP25 Mk. III SPECIAL OFFER £17·45

Garrard SP25 Mk. III
Goldring G800
Teak plinth and tinted cover. All leads supplied.
Please add £1·25 for P. & P.

TURNTABLE

Please add 75p for P. & P.

Garrard SP25 Mk. III	£9·95
Garrard AP76	£17·45
Garrard SL65B	£13·95
Garrard 401	£26·50
Garrard Zero 100 (Auto)	£38·75
Garrard Zero 100 (Single)	£36·55
Garrard 3000	£10·00
Garrard 2025TC with Sonotone 9TAHC	£8·75
BSR MP60	£9·65
Goldring GL72	£21·75
Goldring GL72/P	£28·75
Goldring GL75	£26·95
Goldring GL75/P	£33·95
Goldring 101 PC	£20·00
Wharfedale Linton & cart.	£27·25
Thorens TD125 AB Mk. II New Product	£91·75
Thorens TD150 Mk. II	£26·95
Thorens TD150A Mk. II	£32·95

AMPLIFIERS

Please add 75p P. & P.

Amstrad 8000 Mk. II	£14·95
Amstrad IC2000	£27·50
Amstrad Integra 4000	£21·95
Armstrong 521 (teak cased)	£43·85
Alpha Highgate 212	£24·95
Alpha Highgate FA300	£30·95
Alpha Highgate FA400	£34·50
Keletron 700 new prod.	£19·50
Leak Delta 30	£45·90
Leak Delta 70	£55·75
Metrosound ST20E	£24·20
Metrosound ST60	£45·50
Pioneer SA600	£57·00
Pioneer SA500A	£34·25
Pioneer SA900	£85·00
Pioneer SA1000	£93·00
Rogers R/brook (Chassis)	£35·80
Rogers R/brook (Cased)	£38·95
Rogers R/bourne (Chassis)	£45·50
Rogers R/bourne (Cased)	£49·50
Sinclair PRO60 2 x Z30/PZ5	£14·70
Sinclair PRO60 2 x Z30/PZ6	£16·70
Sinclair PRO60 2 x Z50/PZ8/Trans	£21·25
Sinclair AFU (Filter Unit)	£4·40
Sinclair 605	£17·95
Sinclair 2000 Mk. II	£21·50
Sinclair 3000 Mk. II	£28·50
Wharfedale Linton	£44·25
Teleton SAQ206B	£20·50
Teleton SAQ307	£22·50
Rotel RA 310	£33·75
Rotel RA 610	£50·75

TUNERS

Please add 75p P. & P.

Amstrad Multiplex 3000	£28·75
Armstrong 523	£39·00
Armstrong 524	£30·50
Rogers Ravensbrook FET4 (Chassis)	£31·00
Rogers Ravensbrook FET4 (Cased)	£35·00
Rogers Ravensbourne FET4 (Chassis)	£43·00
Rogers Ravensbourne FET4 (Cased)	£47·50
Sinclair PRO60 (Module)	£15·75
Sinclair 2000/3000 Tuner	£31·00
Philips RH690	£33·00
Leak Delta FM (Cased)	£53·75
Leak Delta AM/FM (Cased)	£64·00
Alpha Highate FT 150	£34·95

TUNER/AMPLIFIERS

Please add 75p for P. & P.

Alpha Highgate 150	£44·25
Armstrong 525 (Teak cased)	£67·50
Armstrong 526 AM/FM (Teak cased)	£77·25
Leak Delta 75	£124·00
Philips RH781	£50·00
Philips RH702	£82·50
Teleton 2100	£29·45
Goodmans One Ten	£99·50
Rogers R/brook (Teak)	£78·50
Rogers R/brook (Chassis)	£72·75
Alpha FR 3000 New prod.	£66·00

SPEAKERS

Please add £1 25 P. & P. per pair

Amstrad 138	£14·70
Wharfedale Denton 2	£28·75
Wharfedale Linton 2	£35·75
Wharfedale Melton 2	£47·45
Wharfedale Dovedale 3	£59·75
Celestion Ditton 120	£38·50
Celestion Ditton 15	£52·75
Celestion Ditton 25	£87·00
Celestion County New Prod	£35·95
Goodmans Double Maxim	£48·00
Goodmans Mezzo 3	£46·95
Goodmans Magister	£77·45

£3·20*

Plus 35p p. & p.
Finished in teak veneer with tinted dust cover fully assembled. For Garrard SP25, 2025TC, 3000, AT60, 2000, 2500, 3500, 5100. 1025, SL65B. Also for BSR McDonald MP60 and others.
For AP76; AP75; SL72B; SL75; SL95B; **£4·20** plus **55p** P. & P.
Also finished in walnut to match Japanese equipment—at no extra.

CARTRIDGES

Please add 10p for P. & P.

Goldring G850	£3·25
Goldring G800	£5·75
Goldring G800E	£7·45
Goldring G800 Super E	£14·35
Shure M3D	£3·85
Shure M447	£4·95
Shure M55E	£5·60
Shure M75E Type 2	£10·00
Sonotone 9TAHC	£1·75

All prices correct at time of press E. & O.E. and are subject to alterations

GLOBAL AUDIO DISCOUNT WAREHOUSES

Dept(EE12) 174 Pentonville Road, London, N1. Telephone 01-278 1769
Or: 4 High View Parade, Redbridge Lane East, Woodford Avenue, Ilford, Essex. Tel: 01-550 1086.

Open Monday to Saturday 9.30 a.m. to 6 p.m. **LATE NIGHT FRIDAY 7 p.m.**

MAIL ORDERS: Order with confidence. Send Postal Order, Cheque, Money Order, Bank Draft, Giro or Cash by Registered Mail. **CALLERS**: Please note that cheques can only be accepted together with cheque cards (not Barclay Card).

2 minutes from **KING'S CROSS, EUSTON & ST. PANCRAS** on main road leading to the East and West Country

---

ERSIN Multicore 5 CORE SOLDER

for fast, easy reliable soldering

Ersin Multicore Solder contains 5 cores of non-corrosive flux, instantly cleaning heavily oxidised surfaces. No extra flux is required.

IDEAL FOR HOME CONSTRUCTORS

Size 1 cartons all at 25p each in 40/60, 60/40, or Savbit alloys in 7 gauges.

EASY-TO-USE DISPENSERS

Size 5
(Savbit) 18swg, 18p (illustrated)
Size 19A
(60/40 alloy) 18swg. 18p
Size 15
(60/40 alloy) 22swg. 22p

BIB WIRE STRIPPER AND CUTTER

Model 3A. Strips insulation from cable or flex without nicking wire. 4 different settings, 4&6 BA spanner ends, ground cutting edges Price 32p. Also available, de luxe Model 8. Price 58p.

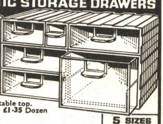
NEW!

From Electrical and Hardware Shops. If unobtainable, write to:
Multicore Solders Ltd., Hemel Hempstead, Herts.

I-N-T-E-R-L-O-C-K-I-N-G PLASTIC STORAGE DRAWERS

NEAT! HANDY! TIDY!

DISCOUNT PRICES



Newest, neatest system ever devised for storing small parts and components: resistors, capacitors, diodes, transistors, etc. Rigid plastic units, interlock together in vertical and horizontal combinations. Transparent plastic drawers have label slots / removable space dividers. Build up any size cabinet for wall, bench or table top.

SINGLE UNITS (5″×2¼″×2¼″) **£1·35** Dozen
DOUBLE UNITS £2·25 Dozen
TREBLE (3D) **£2·35** for 8
DOUBLE TREBLE 2 draws in one outer case (6D2) **£3·65** for 8 extra large size (6D1) **£3·30** for 8.

5 SIZES ALL INTERLOCK

PLUS QUANTITY DISCOUNTS! Order £5 and over Deduct 5% in the £. Order £10 and over Deduct 7½% in the £. Order £20 and over Deduct 10% in the £. Pack./Post./Carr.: Add 35p to all orders under £5. Orders over £5 P/P/C free.

IVORYET LIMITED (Dept. EE11) 124 CRICKLEWOOD BROADWAY, LONDON N.W.2

The most accurate pocket size CALCULATOR *in the world*

The 66 inch OTIS KING scales give you *extra* accuracy. Write today for free booklet, or send £4.65 for this invaluable spiral slide rule on approval with money back guarantee if not satisfied.

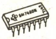
CARBIC LTD. (Dept. EE4)
54 Dundonald Road, London, SW19 3PH.

FREE BOOKLET ON REQUEST

HENRY'S-Your complete Semi-Conductor Store!

INTEGRATED CIRCUITS

Why buy alternatives when you can buy the genuine article from us at competitive prices from stock. BRANDED FROM TEXAS I.T.T FAIRCHILD



Type	1/11 p	12/24 p	25/99 p
SN7400	0·20	0·18	0·16
SN7401	0·20	0·18	0·16
SN7402	0·20	0·18	0·16
SN7403	0·20	0·18	0·16
SN7404	0·20	0·18	0·16
SN7405	0·20	0·18	0·16
SN7406	0·30	0·27	0·25
SN7407	0·30	0·27	0·25
SN7408	0·20	0·19	0·18
SN7409	0·45	0·42	0·35
SN7410	0·20	0·18	0·16
SN7411	0·23	0·22	0·20
SN7412	0·42	0·40	0·35
SN7413	0·30	0·27	0·25
SN7416	0·30	0·27	0·25
SN7417	0·30	0·27	0·25
SN7420	0·20	0·18	0·16
SN7422	0·48	0·44	0·40
SN7423	0·48	0·44	0·40
SN7425	0·48	0·40	0·35
SN7427	0·42	0·39	0·35
SN7428	0·50	0·45	0·42
SN7430	0·20	0·18	0·16
SN7432	0·42	0·39	0·35
SN7433	0·70	0·61	0·44
SN7437	0·65	0·60	0·50
SN7438	0·65	0·60	0·50
SN7440	0·20	0·18	0·16
SN7441AN	0·75	0·72	0·70
SN7442	0·75	0·72	0·70
SN7443	1·00	0·95	0·90
SN7445	2·00	1·75	1·60
SN7446	2·00	1·75	1·60
SN7447	1·75	1·60	1·45
SN7448	1·75	1·60	1·45

Type	1/11 p	12/24 p	25/99 p
SN7450	0·20	0·18	0·16
SN7451	0·20	0·18	0·16
SN7453	0·20	0·18	0·16
SN7454	0·20	0·18	0·16
SN7460	0·20	0·18	0·16
SN7470	0·30	0·27	0·25
SN7472	0·30	0·27	0·25
SN7473	0·40	0·37	0·35
SN7474	0·40	0·37	0·35
SN7475	0·55	0·52	0·50
SN7476	0·45	0·42	0·39
SN7480	0·80	0·75	0·67
SN7481	1·25	1·15	1·10
SN7482	0·87	0·80	0·70
SN7483	1·00	0·90	0·85
SN7484	0·90	0·85	0·80
SN7486	0·45	0·41	0·38
SN7490	0·75	0·70	0·65
SN7491AN	1·00	0·95	0·90
SN7492	0·75	0·70	0·65
SN7493	0·75	0·70	0·65
SN7494	0·80	0·75	0·70
SN7495	0·80	0·75	0·70
SN7496	1·00	0·97	0·95
SN7497	6·25	5·50	5·00
SN74100	2·50	2·30	2·00
SN74104	1·45	1·35	1·20
SN74105	1·45	1·35	1·20
SN74107	0·50	0·45	0·40
SN74110	0·80	0·70	0·60
SN74118	1·00	0·95	0·90
SN74119	1·90	1·78	1·65
SN74121	0·60	0·55	0·50
SN74122	1·35	1·25	1·10
SN74123	2·70	2·55	2·47
SN74141	1·00	0·95	0·90

Type	1/11 p	12/24 p	25/99 p
SN74145	1·50	1·40	1·30
SN74150	3·35	2·95	2·15
SN74151	1·10	0·95	0·90
SN74153	1·35	1·27	1·20
SN74154	2·00	1·75	1·55
SN74155	1·55	1·47	1·35
SN74156	1·55	1·47	1·35
SN74157	1·80	1·70	1·50
SN74160	2·60	2·40	2·25
SN74161	2·60	2·40	2·25
SN74162	3·40	3·25	2·70
SN74163	3·40	3·25	2·70
SN74164	2·75	2·30	2·10
SN74165	4·00	3·50	3·00
SN74166	4·00	3·50	3·00
SN74167	6·25	5·60	5·10
SN74170	4·10	3·55	3·05
SN74174	2·00	1·75	1·30
SN74175	1·35	1·27	1·15
SN74176	1·60	1·35	1·20
SN74177	1·60	1·35	1·20
SN74180	1·55	1·30	1·20
SN74181	7·00	6·00	5·50
SN74182	2·00	1·80	1·60
SN74184	2·40	2·00	1·80
SN74185A	2·40	2·00	1·80
SN74190	1·95	1·85	1·75
SN74191	1·95	1·85	1·75
SN74192	2·00	1·90	1·80
SN74193	2·00	1·90	1·80
SN74194	2·50	2·25	1·90
SN74195	1·85	1·70	1·60
SN74196	1·50	1·40	1·30
SN74197	1·50	1·40	1·30
SN74198	4·60	3·70	3·35
SN74199	4·60	3·70	3·35

PRICES OF 7400 SERIES ARE CALCULATED ON THE TOTAL NUMBER ORDERED REGARDLESS OF MIX

LARGER QUANTITY PRICES PHONE (01) 402 4891

TEXAS HANDBOOK NO. 2. I.C. 700 PAGES DATA **60p.** POST 20p.

HIGH POWER SN 74 HOO }
LOW POWER SM 74 LOO } Now in stock—send for list No. 36

A SELECTION OF SEMI-CONDUCTORS FROM STOCK

Type	Price
AAY30	10p
AAY42	15p
AAZ13	10p
AC107	35p
AC126	25p
AC127	25p
AC128	25p
AC176	25p
AC187	25p
AC188	25p
ACY17	30p
ACY20	20p
ACY21	20p
ACY39	55p
AD140	50p
AD149	50p
AD161	35p
AD162	35p
AF117	20p
AF118	50p
AF124	25p
AF139	30p
AF186	40p
AF239	40p
ASY27	30p
ASY28	25p
BA102	30p
BA115	7p
BA145	15p
BAX13	5p
BAX16	7p
BC107	10p
BC108	10p
BC109	10p
BC109C	12p
BC113	15p
BC117	20p
BC143	35p
BC147	12p
BC169C	12p
BC182	10p
BC214	15p
BCY32	75p
BCY34	35p
BCY39	1·00
BCY42	30p
BCY43	25p
BCY55	2·50
BCY70	15p
BCY71	20p
BCY72	15p
BCY87	2·99
BCZ11	50p
BD124	80p
BD131	75p
BD132	80p
BF115	25p
BF167	25p
BF173	25p
BF179	30p
BF180	30p
BF194	15p
BF195	15p
BFS61	25p
BFS98	25p
BFX13	25p
BFX34	75p
BFX37	30p
BFX88	20p
BFY50	20p
BFY51	20p
BFY52	20p
BFY64	50p
BFY90	59p
BLY36	8·00
BSX20	15p
BSY27	15p
BU105	2·25
BY100	15p
BY126	15p
BY127	15p
BYZ13	35p
C106D	65p
GET111	55p
GET115	55p
GET880	45p
LM309K (T03)	1·87
MAT121	25p
MJE340	50p
MJE370	70p
MJE520	75p
MJE2955	1·10
MJE3055	75p
MPF105	40p
NKT214	20p
NKT216	40p
NKT217	40p
NKT403	70p
NKT404	50p
OA5	50p
OA10	35p
OA81	10p
OA91	7p
OA200	7p
OA202	10p
OC16	75p
OC20	95p
OC23	85p
OC25	40p
OC28	65p
OC35	50p
OC36	65p
OC42	40p
OC44	15p
OC45	15p
OC57	50p
OC71	15p
OC72	25p
OC77	45p
OC81	25p
OC83	25p
OC140	55p
OC170	25p
OC171	30p
OC200	45p
OC201	75p
OC202	80p
OC203	50p
OCP71	1·25
ORP12	50p
ORP60	40p
P346A	20p
RAS310AF	45p
RAS508AF	55p
TAA263	75p
TIL209	39p
TIP29A	50p
TIP30A	60p
TIP31A	60p
TIP32A	70p
TIP33A	1·00
TIP34A	1·50
TIP35A	2·50
TIP36A	3·00
TIP41A	75p
TIP42A	85p
TIS43	35p
V405A	25p
ZTX108	12p
ZTX300	12p
ZTX301	15p
ZTX302	18p
ZTX341	20p
ZTX500	15p
ZTX503	17p
2G301	30p
2N404	20p
2N527	35p
2N696	15p
2N697	15p
2N706	10p
2N930	20p
2N987	45p
2N1131	25p
2N1132	25p
2N1302	18p
2N1304	22p
2N1305	22p
2N1307	25p
2N1308	25p
2N1613	20p
2N1671	1·00
2N2147	75p
2N2160	59p
2N2217	25p
2N2221	20p
2N2222A	25p
2N2369A	15p
2N2906	20p
2N2926 (all cols)	10p
2N3053	20p
2N3054	50p
2N3055	55p
2N3440	75p
2N3442	1·25
2N3525	75p
2N3614	59p
2N3615	75p
2N3702	10p
2N3704	10p
2N3705	10p
2N3714	1·80
2N3771	1·75
2N3773	2·00
2N3790	2·25
2N3819	35p
2N3820	50p
2N3866	85p
2N3903	15p
2N3906	12p
2N4061	12p
2N4062	12p
2N4126	15p
2N4871	35p
2N5457	30p
2N5777	55p
2S001	1·00
2S012	10·00
2S018	6·25
2S026	8·90
2S301	50p
2S303	65p
2S324	95p
40250	50p
40360	40p
40361	40p
40362	50p
40408	50p
40486	75p
40636	1·10
40430	1·00

INTEGRATED CIRCUIT SOCKETS LOW PROFILE PLATED PINS

(16 Lead D.I.L.) 17p

(14 Lead D.I.L.) 15p

(8 Lead D.I.L.) 15p

QUANTITY DISCOUNTS

10% 12+ ; 15% 25+
20% 100+ ; 25% 250+

ANY ONE TYPE

From above sections except Integrated Circuits and Special Offers where discounts are included.

Minimum order value £1 please. Postage 7p on all orders.

SPECIAL OFFERS! SEMI-CONDUCTORS

BFY90 59p
1000 MC/S
25 + 20p
100 + 17p
500 + 15p

AF117 Mullard 25p
25 + 17p
100 + 15p
500 + 12p

OC170 Mullard 25p
25 + 20p
100 + 18p
500 + 15p
1000 + 13p

BY127 Mullard 15p
25 + 12p
100 + 10p
500 + 9p
1000 + 8p

OA202 10p
25 + 8p
100 + 7p
500 + 6p
1000 + 5p

OC35 Mullard 50p
25 + 45p
100 + 40p
500 + 35p
1000 + 30p

2N2926 10p
All Colours
25 + 9p
100 + 8p
500 + 6p
1000 + 5p

2N3819 Texas 35p
25 + 30p
100 + 25p
500 + 20p
1000 + 15p

BC107, BC108, BC109 10p each
All Makes
25 + 8p
100 + 7p
500 + 6p
1000 + 5p

AD161, AD162 35p each
25 + 32p
100 + 28p
500 + 25p
1000 + 22p

2N3053 20p
25 + 18p
100 + 15p
500 + 12p
1000 + 10p

2N3055 55p
25 + 50p
100 + 45p
500 + 38p
1000 + 33p

ZENER DIODES

400 M/W 5%
Miniature
BZY 88 Range

All voltages
3·3 – 33 Volt
10p each.

25+ 9p
100+ 8p
500+ 6·5p
1000+ 5p

Any one type.

1½ Watt 5%
Wire Ends
Metal Case
All voltages
6·8 – 100 Volts
20p each

25+ 18p
100+ 16p
500+ 12p
1000+ 10p

Any one type.

3 Watt Plastic
Wire Ends 5%
3EZ Range

All voltages
6·8 – 100 Volts
30p each.

SILICON RECTIFIERS WIRE ENDED PLASTIC

Type	P.I.V.	1-11
1 amp miniature		
IN4001	50	6
IN4002	100	7
IN4003	200	8
IN4004	400	8
IN4005	600	10
IN4006	800	12
IN4007	1000	15
1·5 amp miniature		
PL4001	50	8
PL4002	100	9
PL4003	200	10
PL4004	400	10
PL4005	600	12
PL4006	800	15
PL4007	1000	16

LINEAR (O/P AMPS)

702C	TO5	75p
709C	TO99	35p
709C	D.I.L.	35p
723C	TO99	£1·00
723C	D.I.L.	95p
725C	TO99	£4·50
741C	TO99	55p
741C	D.I.L.	55p
747C	TO99	£1·10
747C	D.I.L.	£1·10
72741P	D.I.L.	60p
72748P	D.I.L.	60p
SINCLAIR	IC12	£1·50

TOSHIBA
TH9013P
20 WATT AMP
£4·47 POST PAID
TH9014P Pre Amp **£1·50**

DATA AND CIRCUITS REF. 42 **10p**

FREE WITH PURCHASES

TRANSISTORS, IC's, TRIACS, BRIDGES, SCR's, LDR's

NEW FREE BOOKLET (No. 36) OVER 1500 TYPES—

Send for yours today!

PLESSEY INTEGRATED CIRCUIT

3 Watt Amplifier SL403 D
Complete with 8-page booklet, circuits and data

£1.50 each

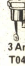
TRIACS

STUD WITH ACCESSORIES

Type	Volts P.I.V.	Price 1-11
3 AMP RANGE		
SC35A	100	75p
SC35B	200	79p
SC35D	400	85p
6 AMP RANGE (TO48)		
SC40A	100	85p
SC40B	200	90p
SC40D	400	£1·00
SC40E	500	£1·20
10 AMP RANGE (TO48)		
SC45A	100	95p
SC45B	200	£1·00
SC45D	400	£1·25
SC45E	500	£1·45
15 AMP RANGE (TO48)		
SC50A	100	£1·25
SC50B	200	£1·35
SC50D	400	£1·65
SC50E	500	£1·85
DIAC D32	25p	

TRIACS—
Additional Types

40430	(TO66)	85p
40669	(Plastic)	£1·00
40486	(TO5)	80p



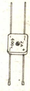
3 Amp T048

15 Amp T048

NEW BRIDGE RECTIFIERS

SMALL SIZE AND LOW COST

Type	Volts P.I.V.	Price 1-11
HALF AMP		
BO5/05	50	20p
BO5/10	100	25p
ONE AMP ¼ × ⅜ H TUBULAR		
B1/05	50	25p
B1/10	100	25p
B1/20	200	30p
B1/60	600	35p
ONE AMP (G.I.) TUBULAR		
W005	50	30p
W01	100	35p
W02	200	40p
W06	600	45p
TWO AMPS ½ H × ½ L × 3/16		
B2/05	50	35p
B2/100	100	40p
B2/200	200	45p
B2/600	600	50p
B2/1000	1000	60p
FOUR AMPS ½H × ½L × 3/16		
B4/100	100	60p
B4/200	200	65p
B4/400	400	70p
B4/600	600	75p
B4/800	800	£1·00
SIX AMPS ½H × ½L × 3/16		
B6/100	100	70p
B6/200	200	75p
B6/400	400	90p
B6/600	600	£1·00



SILICON CONTROLLED RECTIFIERS

Type	Volts P.I.V.	Price 1-11
ONE AMP		
CRS 1/05	50	25p
CRS 1/10	100	30p
CRS 1/20	200	30p
CRS 1/40	400	35p
CRS 1/60	600	45p
THREE AMP (TO48)		
CRS 3/05	50	30p
CRS 3/10	100	30p
CRS 3/20	200	35p
CRS 3/40	400	45p
CRS 3/60	600	55p
FIVE AMP (TO66)		
CRS 5/400	400	60p
SEVEN AMP (TO48)		
CRS 7/100	100	60p
CRS 7/200	200	65p
CRS 7/400	400	70p
CRS 7/600	600	95p
SIXTEEN AMP		
SCR 16/100	100	65p
SCR 16/200	200	70p
SCR 16/400	400	80p
SCR 16/600	600	£1·00

1 Amp T05

3 Amp T048

HENRY'S RADIO LIMITED

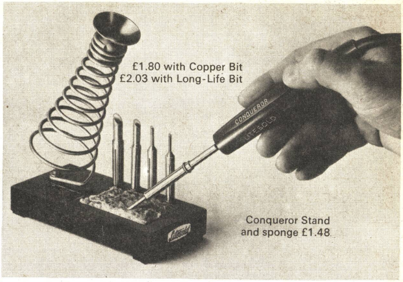
MAIL ORDER DEPT: 303 EDGWARE ROAD, LONDON, W.2.
RETAIL SHOP: 404-406 EDGWARE ROAD. (01-402 8381/2)
Open 6 days a week 9 am – 6 pm Monday to Saturday

The Litesold CONQUEROR

An outstandingly simple and efficient new soldering tool, featuring a fully enclosed element and slip-on bits which can't seize. Five tip sizes available, $\frac{1}{16}$in to $\frac{1}{4}$in, covering most work with one iron only. Lighter and slimmer than comparable irons, and with better performance. A pleasure to use and excellent value. Mains or low voltages. Conqueror spring stand gives complete safety and convenience, and holds spare bits.

Note that we are now supplying a range of small pliers, cutters, soldering aids and other small tools for use in Electronics.
Please ask for leaflet.

Please ask for leaflet **54/1016.**



LIGHT SOLDERING DEVELOPMENTS LTD.

28 Sydenham Road . Croydon CR9 2LL **01-688 8589/4559**

Have fun with electronics...

PHILIPS Radionic Construction Kits

NO SOLDERING
BATTERY OPERATED

Build your own radio receiver and many exciting experiments with the unique printed circuit board and mounted components. Easy to build, no soldering, battery operated, plus a fully illustrated instruction manual giving precise directions for each experiment. Ideally suitable for both the experimenter and beginner.

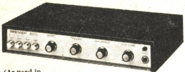
Radionic Products Limited
St. Lawrence House, Broad Street, Bristol BS1 2HF.
Tel: 0272 25351
Amember of the ESL BRISTOL Group of Companies.

PHILIPS

Please send me literature
on Radionic radio and electronics
construction kits.

NAME________________________
ADDRESS______________________
____
EE

PREMIER 800
STEREO AMPLIFIER



(As used in
SYSTEM '800')

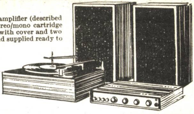
A truly high quality stereo amplifier—compare the specification, compare the price. Output: 5 watts per channel. Frequency response: 30-20,000 Hz = 2 db. Distortion: 1% Output Impedance 8 ohms nom. Inputs equalised to R.I.A.A. Magnetic 4mV. Ceramic 100mV. Tuner 100mV. Tape 100mV. Tape out 150mV. Din sockets for inputs and outputs. Controls: Bass, Treble, Volume, Balance, Selector. Mono/Stereo switch. Stereo headphone socket. Attractive slim line design black leatherette cabinet with aluminium front panel. Size 12¼" x 6¾" x 2⅜".

ONLY **£15·00** Carr. 50p.

Mk. 11 Version available with Teak Finish Cabinet. **£16·25.** Carr. 50p.

PREMIER HI-FI STEREO SYSTEMS

SYSTEM "800"



Consists of the Premier 800 Mk II all transistor stereo amplifier (described left) Garrard auto/manual record player unit fitted stereo/mono cartridge with diamond stylus and mounted in teak finish plinth with cover and two cloth front loudspeaker systems. Absolutely complete and supplied ready to plug in and play. The 800 Mk II amplifier has an output of 5 watts per channel with inputs for ceramic and magnetic pick-up, tape and tuner also tape output socket and headphone socket. Controls: Bass, Treble. Volume, Balance, Selector. Mono/Stereo switch. Headphone socket. Power on/off. Teak finish cabinet with aluminium front panel. Size: 12¼in × 6¾in × 2⅜in.

£35·00

Carr. £1·75

SYSTEM "TWO"

as above but with slotted front teak finish loudspeakers, Garrard SP25 Mk. III and magnetic cartridge.

£45·00

Carr. £1·75

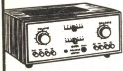
SYSTEM "THREE"

This consists of KLINGER KC903 stereo amplifier giving 6 watts rms per channel with Bass, Treble, Volume and Balance Controls. Inputs for Magnetic and Ceramic pick-up, tuner, tape in and out. Stereo headphone socket. Garrard SP25 Mk. III in teak finish plinth with cover and fitted Sonotone 9TAHCD diamond stereo cartridge. A pair of HMF Speakers size 16½" × 10¼" × 9" fitted EMI units complete the matching system.

£57·75 Carr. £1·75

FREE
LEADS AND PLUGS SUPPLIED WITH ALL SYSTEMS

PREMIER PARAGON
STEREO HI-FI AMPLIFIER

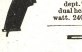


Gives the best possible reproduction of records, radio and tape at a reasonable price.

Fitted with all the controls and facilities you're ever likely to want, the Paragon gives you a degree of sophistication that is usually only found with amplifiers costing twice its price. It has bass and treble slide controls, volume and balance knobs, and eight push-buttons. There's also a standard stereo jack socket on the front panel, plus a ceramic/magnetic cartridge switch and a mains outlet socket on the back panel.

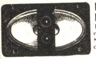
Specifications 10 + 10 watts into 8 ohms. Power/frequency response: 0dB 10 watts into 8 ohms -3dB 20Hz - 25KHz. Distortion typically less than 0·25%. Inputs for Magnetic phono (4mV) Crystal phono (66mV) Radio/Tape (100mV). High and low filters. Teak finish cabinet. Size: 12¾" × 5⅞" × 10½".

£32·50 P. & P. 50p.



WELLER "EXPERT" SOLDER GUN. Saves time and simplifies soldering in the home and service dept. Two position trigger gives instant dual heat. 100/140 watt. 240 volt A.C. **£3·95** P. & P. 50p

"Litesold" Soldering Iron. Lightweight 3/16" pencil bit. Ideal for regular bench use and around the home. 25 watts. 240 volt A.C. **£1·50** P. & P. 16p



E.M.I. 13×8in. HI-FI SPEAKERS

Fitted two 2½in tweeters and crossover network. Impedance 8 or 15 ohm. Handling capacity 10W. Brand new.

£3·47 P. & P. 50p

PREMIER HI-FI OFFERS

Rogers Ravensbrook II Stereo Amplifier teak **£38·50**

Rogers Ravensbourne Stereo Amplifier teak **£49·00**

Metrosound ST20E Stereo Amplifier teak **£25·50**

Goldring GL72 less cartridge **£22·00**

Garrard SP25 III with Goldring G800 cartridge **£15·00**

P. & P. 60p extra any of above.

GARRARD SP25 MK III SINGLE RECORD PLAYER FITTED GOLDRING 800 MAGNETIC STEREO CARTRIDGE. COMPLETE IN TEAK PLINTH WITH COVER.

Total list price over £34.

PREMIER PRICE
£17·95
P. & P. £1

Garrard AP76 with G800, ready wired to 5 pin Din in plinth with cover **£29·50** P. & P. £1

Garrard AP76 less cartridge P. & P. 60p. **£18·80**

Garrard 401 Transcription Unit P. & P. 60p **£27·40**

Garrard 2025 T/C with Stereo Ceramic Cartridge **£8·50** P. & P. 60p

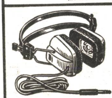
Garrard 2025 T/C with Stereo Ceramic Cartridge ready wired in teak plinth with cover **£12·45** P. & P. £1

CARTRIDGE BARGAINS!
Goldring G800H £5.00; G800 £5.50; G800E £9·50; P. & P. 10p

METER BARGAIN

MODEL GT-800 MULTIMETER

A precision made pocket sized test meter, ideally suited for testing electronic circuits or electronic appliances. Supplied complete with test lead and batteries. RANGES—DC Voltages: 10, 50, 250, 1,000V (1,000 opV). AC Voltage: 10, 50, 250, 1,000V (1,000opV). DC Current: 1mA, 100mA. Resistance: 0·150K ohms. Decibel: —10 to +22db (at AC 10V range) **£2·47**, P. & P. 25p.



HI-FI STEREO HEADPHONES

Designed to the highest possible standard. Fitted 2½in. speaker units with soft padded ear muffs. Adjustable headband. 8 ohms impedance. Complete with 6ft lead and stereo jack plug.

£2·47 P. & P. 25p.

VERITAS V-149 MIXER

Battery operated 4-channel audio mixer providing four separate inputs. Size 6 × 3 × 2in. suitable for crystal microphone low impedance microphone, with transformer, radio, tape, etc. Max. input 1·5v. Max. output 2·5v. Gain 6 dB. Standard jack plug socket inputs, phonoplugs output. Attractive teak wood grain finish case.

MONO MODEL **£3**   STEREO MODEL **£3.47** P. & P. 15p

GENUINE EMI—TAPE COMPACT CASSETTES LOW NOISE BRAND NEW IN LIBRARY CASES

C60 (List 71p) **45p**
C90 (List 98p) **65p**
C120 (List £1·48) **85p**
P. & P. 10p

LOW-NOISE COMPACT CASSETTES

Screw fixing—fully guaranteed.
In Library cases.

C60—**29p**	3 for **81p**
C90—**40p**	3 for **£1·11**
C120—**52p**	3 for **£1·40**

P. & P. 10p each (3 and over 15p)

"VERITONE" RECORDING TAPE

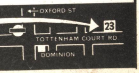
SPECIALLY MANUFACTURED IN U.S.A. FROM EXTRA STRONG PRE-STRETCHED MATERIAL. THE QUALITY IS UNEQUALLED. TENSILISED to ensure the most permanent base. Highly resistant to breakage, moisture, heat, cold or humidity. High polished splice free finish. Smooth output throughout the entire audio range. Double wrapped–attractively boxed.

TT3	3"	450'	POLYESTER	37p
DT3	3½"	600'	POLYESTER	57p
SP5	5"	600'	P.V.C.	42p
LP5	5"	900'	ACETATE	50p
DT5	5"	1200'	POLYESTER	75p
LP6	5¾"	1200'	ACETATE	75p
DT6	5¾"	1800'	POLYESTER	£1·12
TT6	5¾"	2400'	POLYESTER	£1·87
SP7	7"	1200'	P.V.C.	62p
LP7	7"	1800'	ACETATE	75p
DT7	7"	2400'	POLYESTER	£1·25
TT7	7"	3600'	POLYESTER	£2·50

TAPE SPOOLS 3" 5p, 5", 5¾', 7" 9p.
Post and Packing 3" 5p, 5" ,5¾", 8p, 7" 10p (3 reels and over Post Free).

PREMIER RADIO

23, TOTTENHAM COURT ROAD, LONDON, W.1 Tel: 01-636 3451



SEW PANEL METERS

USED EXTENSIVELY BY INDUSTRY, GOVERNMENT DEPARTMENTS, EDUCATIONAL AUTHORITIES, ETC.

● LOW COST ● QUICK DELIVERY ● OVER 200 RANGES IN STOCK ● OTHER RANGES TO ORDER

NEW "SEW" DESIGNS!

CLEAR PLASTIC METERS

TYPE SW.100
100 x 80 mm.

50μA	£3·80
50–0–50μA	£3·80
100μA	£3·80
100–0–100μA	£3·70
500μA	£3·50
1mA	£3·40
20V. D.C.	£3·40
50V. D.C.	£3·40
300V. D.C.	£3·40
1 amp. D.C.	£3·40
5 amp. D.C.	£3·40
300V. A.C.	£3·40
VU Meter	£4·15

BAKELITE PANEL METERS

TYPE S-80
80 mm.
square fronts

50μA	£3·50
50–0–50μA	£3·40
100μA	£3·40
100–0–100μA	£3·30
500μA	£3·05
1mA	£2·85
20V. D.C.	£2·85
50V. D.C.	£2·85
300V. D.C.	£2·85
1 amp. D.C.	£2·85
5 amp. D.C.	£2·85
300V. A.C.	£2·85
VU Meter	£3·70

"SEW" CLEAR PLASTIC METERS

Type MR.85P. 4¼in. × 4¾in. fronts.

50μA	£3·95
50–0–50μA	£3·40
100μA	£3·40
100–0–100μA	£3·30
200μA	£3·30
500μA	£3·20
500–0–500μA	£3·10
1mA	£3·10
1–0–1mA	£3·10
5mA	£3·10
10mA	£3·10
50mA	£3·10
100mA	£3·10
500mA	£3·10
1 amp.	£3·10
5 amp.	£3·10
15 amp.	£3·10
30 amp.	£3·20
20V. D.C.	£3·10
50V. D.C.	£3·10
150V. D.C.	£3·10
300V. D.C.	£3·10
15V. A.C.	£3·10
300V. A.C.	£3·10
S Meter 1mA	£3·15
VU Meter	£3·95
1 amp. A.C.*	£3·10
5 amp. A.C.*	£3·10
10 amp. A.C.*	£3·10
20 amp. A.C.*	£3·10
30 amp. A.C.*	£3·10

Type MR.52P. 2⅜in. square fronts.

50μA	£3·40
50–0–50μA	£2·85
100μA	£2·85
100–0–100μA	£2·75
500μA	£2·55
1mA	£2·20
5mA	£2·20
10mA	£2·20
50mA	£2·20
100mA	£2·20
500mA	£2·20
1 amp.	£2·20
5 amp.	£2·20
10V. D.C.	£2·20
20V. D.C.	£2·20
50V. D.C.	£2·20
300V. D.C.	£2·20
15V. A.C.	£2·30
300V. A.C.	£2·30
S Meter 1mA	£2·30
VU Meter	£3·50
1 amp. A.C.*	£2·20
5 amp. A.C.*	£2·20
10 amp. A.C.*	£2·20
20 amp. A.C.*	£2·20
30 amp. A.C.*	£2·20

Type MR.65P. 3⅜in. × 3¼in. fronts.

50μA	£3·70
50–0–50μA	£3·00
100μA	£3·00
100–0–100μA	£2·90
200μA	£2·90
500μA	£2·65
500–0–500μA	£2·40
1mA	£2·40
5mA	£2·40
10mA	£2·40
50mA	£2·40
100mA	£2·40
500mA	£2·40
1 amp.	£2·40
5 amp.	£2·40
10 amp.	£2·40
15 amp.	£2·40
20 amp.	£2·40
30 amp.	£2·55
50 amp.	£2·75
5V. D.C.	£2·40
10V. D.C.	£2·40
20V. D.C.	£2·40
50V. D.C.	£2·40
150V. D.C.	£2·40
300V. D.C.	£2·40
15V. A.C.	£2·55
50V. A.C.	£2·55
150V. A.C.	£2·55
300V. A.C.	£2·55
500V. A.C.	£2·55
S Meter 1mA	£2·60
VU Meter	£3·70
50mA A.C.*	£2·40
100mA A.C.*	£2·40
200mA A.C.*	£2·40
500mA A.C.*	£2·40
1 amp. A.C.*	£2·40
5 amp. A.C.*	£2·40
10 amp. A.C.*	£2·40
20 amp. A.C.*	£2·40
30 amp. A.C.*	£2·40

*MOVING IRON— ALL OTHERS MOVING COIL

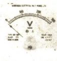
Please add postage

SEW EDUCATIONAL METERS

Type ED.107. Size overall 100mm × 90mm × 108mm. A new range of high quality moving coil instruments ideal for school experiments and other bench applications. 3" mirror scale. The meter movement is easily accessible to demonstrate internal working. Available in the following ranges:

50μA	£5·50
100μA	£5·10
1mA	£4·85
50-0-50μA	£5·10
1-0-1mA	£4·85
1A d.c.	£4·85
5A d.c.	£4·85
10V d.c.	£4·85
20V d.c.	£4·85
50V d.c.	£4·85
300V d.c.	£4·85
Dual range	
500mA/5A d.c.	£5·10
5V/50V d.c.	£5·10

Type MR.38P. 1 21/32in. square fronts.



50μA	£2·30
50–0–50μA	£2·10
100μA	£2·10
100–0–100μA	£1·95
200μA	£1·95
500μA	£1·80
500–0–500μA	£1·75
1mA	£1·75
1–0–1mA	£1·75
2mA	£1·75
5mA	£1·75
10mA	£1·75
20mA	£1·75
50mA	£1·75
100mA	£1·75
150mA	£1·75
200mA	£1·75
300mA	£1·75
500mA	£1·75
750mA	£1·75
1 amp.	£1·75
2 amp.	£1·75
5 amp.	£1·75
10 amp.	£1·75
3V. D.C.	£1·75
10V. D.C.	£1·75
15V. D.C.	£1·75
20V. D.C.	£1·75
50V. D.C.	£1·75
100V. D.C.	£1·75
150V. D.C.	£1·75
300V. D.C.	£1·75
500V. D.C.	£1·75
750V. D.C.	£1·75
15V. A.C.	£1·85
50V. A.C.	£1·85
150V. A.C.	£1·85
300V. A.C.	£1·85
500V. A.C.	£1·85
S Meter 1mA	£1·85
VU Meter	£2·30

Type MR.45P. 2in. square fronts.

50μA	£2·50
50–0–50μA	£2·30
100μA	£2·30
100–0–100μA	£2·05
200μA	£2·05
500μA	£1·95
500–0–500μA	£1·85
1mA	£1·85
5mA	£1·85
10mA	£1·85
50mA	£1·85
100mA	£1·85
500mA	£1·85
1 amp	£1·85
5 amp.	£1·85
10V. D.C.	£1·85
20V. D.C.	£1·85
50V. D.C.	£1·85
300V. D.C.	£1·85
15V. A.C.	£2·00
300V. A.C.	£2·00
S Meter 1mA	£2·05
VU Meter	£2·50
1 amp. A.C.*	£1·85
5 amp. A.C.*	£1·85
10 amp. A.C.*	£1·85
20 amp. A.C.*	£1·85
30 amp. A.C.*	£1·85

"SEW" BAKELITE PANEL METERS

Type MR.65. 3¼in. square fronts.

25μA	£3·85
50μA	£3·00
50–0–50μA	£2·60
100μA	£2·60
100–0–100μA	£2·50
500μA	£2·45
500–0–500μA	£2·15
1mA	£2·15
1–0–1mA	£2·15
5mA	£2·15
10mA	£2·15
50mA	£2·15
100mA	£2·15
500mA	£2·15
1 amp.	£2·15
5 amp.	£2·15
15 amp.	£2·15
30 amp.	£2·15
50 amp.	£2·15
5V. D.C.	£2·15
10V. D.C.	£2·15
20V. D.C.	£2·15
50V. D.C.	£2·15
150V. D.C.	£2·15
300V. D.C.	£2·15
50mV D.C.	£2·40
100mV D.C.	£2·40
30V. A.C.*	£2·20
50V. A.C.*	£2.20
150V. A.C.*	£2·20
300V. A.C.*	£2·20
500mA A.C.*	£2·15
1 amp. A.C.*	£2·15
5 amp. A.C.*	£2·15
10 amp. A.C.*	£2·15
20 amp. A.C.*	£2·15
30 amp. A.C.*	£2·15
50 amp. A.C.*	£2·15
VUMeter	£3·40

EDGWISE METERS

Type PE.70. 3 17/32in. × 1 15/32in. × 2¼ in. deep.

50μA	£3·40
50–0–50μA	£3·30
100μA	£3·30
100–0–100μA	£3·20
200μA	£3·20
500μA	£3·05
1mA	£2·70
300V. A.C.	£2·70
VU Meter	£3·75

Send for illustrated brochure on SEW Panel Meters—discounts for quantities.

MULTIMETERS *for EVERY purpose!*

ROUND SCALE TYPE PENCIL TESTER MODEL TS.68

Completely portable, simple to use pocket sized tester. Ranges 0/3/30/300V AC and DC at 2,000 o.p.v. Resistance 0-20K ohms. ONLY £1·97 P. & P. 13p

SKYWOOD SW-500 50KΩ/Volt. Mirror scale DC Volts 0.6/3/12/30/300/600. DC Current 20uA/6/600mA Resistance 10K/100K/1 Meg/10 Meg. Decibels — 20 to +57 db. £7·50. P & P. 15p.

MODEL 5025 57 Ranges Giant 5¼in. Meter, Polarity Reverse Switch. Sensitivity: 50K/Volt D.C. 5K/Volt A.C. D.C. Volts: ·125, ·25, 1·25, 5, 10, 25, 50, 125, 250, 500, 1,000V. A.C. Volts: 1·5, 3, 5, 10, 25, 50, 125, 250, 500, 1,000V. D.C. Current: 25, 50IA, 2·5, 5, 25, 50, 250, 500mA, 5, 10 amp. Resistance: 2K, 10K, 100K, 1MEG, 10MEG. Decibels: −20 to +85 dB. £12·50. P. & P. 17½p

TE-20RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 kc/s–260 Mc/s on 6 bands. Directly calibrated variable R.F. attenuator. Operation 200/240V. A.C. Brand new with instruction. £15. P. & P. 37½p. S.A.E. for details.

TE-20D RF SIGNAL GENERATOR

Accurate wide range signal generator covering 120 Kc/s-500 Mc/s on 6 bands. Directly calibrated Variable R.F. attenuator, audio output. Xtal socket for calibration. 220/240V. A.C. Brand new with instructions £15. Carr. 37½p. Size 140 × 215 × 170 mm.

BELCO DA-20 SOLID STATE DECADE AUDIO OSCILLATOR

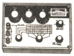
New high quality portable instrument. Sine 1 Hz to 100 KHz. Square 20 Hz to 20 KHz. Output max + 10 dB (10 K ohms). Operation 220/240v. A.C. Size 215mm x 150mm x 120mm. Price £27·50. Carr. 25p.

240° Wide Angle 1mA Meters

MW1-6	60mm square	£3·97½
MW1-8	80mm square	£4·97½

P. & P. extra

TRANSISTORISED L.C.R. A.C. MEASURING BRIDGE



A new portable bridge offering excellent range and accuracy at low cost. Ranges: R. 1Ω–11·1 megΩ 6 Ranges ±1% L.1 μ H - 111 HENRYS 6 Ranges2 = %C.10pF ± 1110mFd. 6 Ranges ±2%. TURNS RATIO 1:1/1000–1:11100. 6 Ranges ±1%. Bridge voltage at 1,000 cps. Operated from 9 volts. 100μA. Meter indication. Attractive 2 tone metal case. Size 7⅝ × 5 × 2in. £20. P. & P. 25p

230V/240V SMITHS SYNCHRONOUS GEARED MOTORS

Built in gearbox. All brand new and boxed 60 RPM CW: 30 RPH CW; 2R/HR ACW; 2R/HR CW; 8R/DAY CW; 10 RPM CW; 50p each, Post 12p.

HIOKI MODEL 720X 20,000 O.P.V.
Overload protection.
5/25/100/500/1000 VDC.
10/50/250/1000 VAC.
50 uA/250 mA. 20K/2 meg ohm. −5 to + 62db.
£4·97. P. & P. 15p.

Model S-100TR MULTI-METER TRANSISTOR TESTER 100,000 o.p.v. MIRROR SCALE OVER-LOAD PROTECTION
0/·12—·6/3/12/30/120/600 V DC.
0/6/30/120/600 V. AC.
0/12/600uA/12/300MA/12 Amp. DC.
0/10K/1 MEG/100 MEG.
−20 to + 50 db.
0·01— ·2 mfd.
Transistor tester measures Alpha, beta and Ico. Complete with batteries, instructions and leads. £13·50, P.P. 25p.

MODEL 500 30,000 O.P.V. with overload protection mirror scale 0/·5/2·5/10/25/100/250/500/1,000 V. D.C. 0/2·5/10/25/100/250/500/1,000V. A.C. 0/50μA/5/50/500mA. 12 amp. D.C. 0/60/K/6 Meg./60 MegΩ. £8·87½. Post paid.

TMK LAB TESTER. 100,000 O.P.V. 6½in. Scale Buzzer Short Circuit Check. Sensitivity: 100,000 O.P.V. D.C. 5K/Volt A.C. D.C. Volts: ·5, 2·5, 10, 50, 250, 1,000 V. A.C. Volts: 3, 10, 50, 50, 250, 500, 1,000V. D.C. Current: 10, 100μA, 10, 100, 500mA, 2·5, 10 amp. Resistance: 1K, 10K. 100K, 10MEG, 100 MEGΩ. Decibels: −10 to +49 db. Plastic Case with Carrying Handle. Size 7½in. x 6⅜in. x 3⅞in. £18·90. P. & P. 25p.

RUSSIAN 22 RANGE MULTIMETER

Model U437 10,000 o.p.v. A first class versatile instrument manufactured in U.S.S.R. to the highest standards. Ranges: 2·5/10/50/250/500/1000v D.C. 2·5/10/50/250/500/1000v A.C. DC Current 100 wA/1/10/100mA/1A. Resistance 300 ohms/3/30/300K/3M Ω. Complete with batteries, test leads, instructions and sturdy steel carrying case. OUR PRICE £5·97 P. & P. 25p.

TO-3 PORTABLE OSCILLOSCOPE

3in. tube. Y amp. Sensitivity 0·1v p-p/CM. Bandwidth 1·5 cps–1·5 MHz. Input imp. 2 meg Ω 25pF X amp. sensitivity 0·9v. p-p/CM. Bandwidth 1.5 cps –800KHz. Input imp. 2 meg Ω 20pF. Time base. 5 ranges 10 cps–300 KHz. Synchronization. Internal/external. Illuminated scale 140 × 215 × 330 mm. Weight 15½ lb. 220/240V. A.C. Supplied brand new with handbook. £40·00. Carr. 50p

HONEYWELL DIGITAL VOLTMETER VT.100

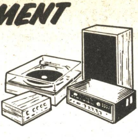
Can be panel or bench mounted. Basic meter measures 1 volt D.C. but can be used to measure a wide range of AC and DC volt, current and ohms with optional plug in cards. Specification: Accuracy: ± 0·2, ± 1 digit. Resolution: 1mV. Number of digits: 3 plus fourth overrange digit. Overrange: 100% (up to 1·999). Input impedance: 1000 Meg ohm. Measuring cycle: 1 per second. Adjustment: Automatic zeroing, full scale adjustment against an internal reference voltage. Overload: to 100v. D.C. Input: Fully floating (3 poles). Input power: 110-230v. A.C. 50/60 cycles. Overall size: 5⅝in. x 2 13/16in. x 8 3/16in. AVAILABLE BRAND NEW AND FULLY GUARANTEED ONLY £35·00. Carr. 50p.

G. W. SMITH
& CO (RADIO) LTD.
Also see opposite page

HI-FI EQUIPMENT

SAVE UP TO 33⅓% OR MORE

SEND S.A.E. FOR DISCOUNT PRICE LISTS AND PACKAGE OFFERS!



RECORD DECKS

BSR

UA50†	£4·97
C129†	£6·50
MP60......	£10·40
610........	£14·07
510........	£11·50
310........	£9·40
810........	£33·45
MP60/ G800* ..	£12·90
MP60 TPD1	£17·12
MP60/TPD1/ G800* ..	£19·50
MP60 TPD2	£15·40
610 TPD1	£20·35
510 TPD1	£18·20
210 Package*	£9·55
HT 70	£14·99
HT70/ G800* ..	£17·25
HT 70 Pack	£21·60
HT70/Pack/ G800* ..	£23·95

GARRARD

2025 T/C*..	£8·50
40B*......	£9·25
SP25 III ..	£10·25
SL65B	£13·45
AP76	£18·85
SL72B	£22·95
SL95B	£32·50
401........	£26·60
ZERO 100A	£39·95
ZERO 100S	£37·50

GOLDRING

GL69/2	£18·97
GL69/2/P ..	£24·20
GL72......	£23·50
GL72/P....	£30·55
GL75......	£31·35
GL75P	£38·65
LID75	£3·95
LID72	£3·55
G99	£22·20
GL85P/C ..	£65·25
LID85	£5·25
G101	£22·20

PIONEER

PL12AC ..	£35·80
PL15C	£51·35
PLA35	£82·65

THORENS

TD125/11 ..	£69·95
TD125AB/11	£105·00
TX25......	£7·40
TD160C ..	£58·95
TD150	£29·50
TD150A II	£36·95
TD150AB II	£39·95
TD150 Plinth	£3·80
TXII......	£3·85

† Mono * Stereo Cartridge

All other models less Cartridge

Carriage 50p extra any model.

RECORD DECK PACKAGES

Decks supplied with cartridge ready wired in teak veneered plinth with cover.

Garrard 2025TC/9TAHCD........	£12·95
Garrard SP25 III/9TAHCD	£16·95
Garrard SP25 III/G800..........	£18·50
Garrard SP25 III/M75-6	£19·50
Garrard SP25 III/M44-7	£19·75
Garrard SP25 III/M44-E	£20·95
Garrard SP25 III/M55-E	£22·40
SP25 III/G800 (Play on P&C) ..	£19·75
Garrard AP76/G800	£28·75
Garrard AP76/M75-6	£30·25
Garrard AP76/M55E	£32·25
Garrard AP76/M75EJ	£34·25
Garrard AP76/G800E	£30·75
Garrard AP76/M44-E	£31·15
Garrard AP76/M75ED	£38·95
BSR McDonald MP60/G800	£19·95
BSR McDonald MP60/M44-7......	£20·95
BSR McDonald MP60/M44-E	£21·50
Goldring GL72/G800	£34·50
Goldring GL75/G800	£41·95
Goldring GL75/G800E	£44·95

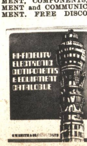
Carriage 50p any item.

U4312 MULTIMETER

Extremely sturdy instrument for general electrical use. 667 o.p.v.
0/·3/1·5/7·5/30/60/150/300/600/900 VDC and 75mV.
0/·3/1·5/7·5/30/60/150/300 600/900VAC.
0/300uA/1·5/6/50/60/150/600MA/1·5/6 AMP. D.C.
0/1·5/6/15/60/150/600MA/1.5/6 AMP. AC.
0/200 Ω/3K/30K Ω.
Accuracy DC 1%, AC 1·5%. Knife, edge pointer, mirror scale. Complete with sturdy metal carrying case, leads and instructions. **£9·50** plus P. & P. 25p.

LATEST CATALOGUE

Our 7th edition gives full details of a comprehensive range of HI-FI EQUIPMENT, COMPONENTS, TEST EQUIPMENT and COMMUNICATIONS EQUIPMENT. FREE DISCOUNT COUPONS VALUE 50p 320 pages, fully illustrated and detailing thousands of bargains.

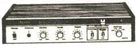


SEND NOW

ONLY 40p

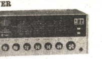
P & P 10p

TELETON SAQ-206B STEREO AMPLIFIER



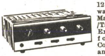
Latest exciting release. Brand new model. 6 + 6 watts rms. Inputs for mag, xtal, aux tape. Volume, bass, treble, sliding balance, scratch filter and loudness controls.
OUR PRICE **£22·95** Carr. 37p.

SKYWOOD CX203 COMMUNICATION RECEIVER



Solid state. Coverage on 5 bands 200-420 KHz and ·55 to 30 MHz. Illuminated slide rule dial. Bandspread. Aerial tuning. BFO. AVC. ANL. 'S' meter. AM/CW/SS B. Integrated speaker and phone socket. Operation 220/240v AC or 12v DC. Size 325 x 266 x 150 mm. Complete with instructions and circuit. **£28·50.** Carr. 50p

LAFAYETTE LA. 324 STEREO AMPLIFIER



12.5 + 12.5 watt R.M.S. Mag/Cer/Tuner/Tape Inputs. Excellent performance. Compares with amplifiers up to £40.
OUR PRICE **£24,** Carr. 37½p.

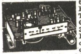
TAPE CASSETTES

Top quality Hi Fi Low Noise in Philips Library cases.

C60	3 for **75p**	10 for **£2·35**	P. & P.
C90	3 for **£1·05**	10 for **£3·30**	10p
C120	3 for **£1·35**	10 for **£4·20**	extra

Tape Head Cleaner **30p** each

★ TRANSISTORISED FM TUNER



6 TRANSISTOR HIGH QUALITY TUNER, SIZE ONLY 6×4×2½in. 3 I.F. stages. Double tuned discriminator. Ample output to feed most amplifiers. Operates on 9 V battery. Coverage 88–108Mc/s. Ready built ready for use. Fantastic value for money. **£6·37½.** P. & P. 12½p. Stereo multiplex adaptors **£4·97½.**

TMK MODEL 117 F.E.T. ELECTRONIC VOLTMETER

Battery operated, 11 meg input, 26 ranges. Large 4⅜" mirror scale. Size 5⅞" x 4⅜" x 2⅜". DC VOLTS 0 3 – 1200V. AC VOLTS 3 – 300V RMS. 8·0 – 800V P-P. DC CURRENT ·12 – 12MA. Resistance up to 2000M ohm. Decibels – 20 to + 51 db Complete with leads/instructions. **£17.50,** P. & P. 20p.

MCA. 220 AUTOMATIC VOLTAGE STABILISER

Input 88-125 VAC or 176-250VAC. Output 120VAC or 240VAC. 200VA rating. **£11·97.** Carr. 50p.

SINCLAIR IC-12

List Price **£2·98**

OUR PRICE **£1·80**

P. & P. 10p

HOMER INTERCOMS

Ideal for home, office, stores, factories, etc. Supplied complete with batteries, cable and free instructions.

2 Station **£2.97,** P. & P. 15p.
3 Station **£5.25,** P. & P. 15p.
4 Station **£6.62,** P. & P. 17p.

EMI LOUDSPEAKERS

Model 350. 13" x 8" with single tweeter/crossover. 20-20,000 Hz. 15 watt RMS. Available 8 or 15 ohms. **£7·50** each. P. & P. 37p.

Model 450. 13" x 8" with twin tweeters/crossover. 55-13,000 Hz. 8 watt RMS. Available 8 or 15 ohms. **£3·50** each. P. & P. 25p.

TE 1018 DE-LUXE MONO HIGH IMPEDANCE HEADSET

Sensitive, soft earpads, adjustable headband. Magnetic, impedance 2,600 ohms.
£1·97, P. & P. 15p.

MP7 MIXER PREAMPLIFIER

5 microphone inputs each with individual gain controls enabling complete mixing facilities. Battery operated. 9¼" x 5" x 3". Inputs Mics: 3 x 3mV 50K; 2 x 3mV 600 ohm. Phono meg. 4mV 50K. Phono ceramic 100mV 1 meg. Output 250mV 100K.
£8.97. P. & P. 20p.

1021 STEREO LISTENING STATION

For balancing and gain selection of loudspeakers with additional facility for stereo headphone switching. 2 gain controls, speaker on-off slide switch, stereo headphone sockets. 6" x 4" x 2¼". **£2·25,** P. & P. 15p.

PRS-2 PHOTO ELECTRIC RELAY SYSTEM

Inexpensive warning or counting system consisting of an enciter and relay unit. Relay unit has variable sensitivity control and switch for intermittent alarm operation. Enciter unit has removable infra red filter and A.C. outlet socket to operate bells, counters, etc. 240V AC. Complete with cables and instructions. **£9.97** P. .& P, 25p

230 VOLT A.C. 50 CYCLES RELAYS

Brand new. 3 sets of changeover contacts at 5 amp rating. **50p** each. P. & P. 10p (100 lots **£40**) Quantities available.

SPECIAL OFFER! SINCLAIR PROJECT 60 STEREO FM TUNER

The first tuner in the world to use the phase lock loop principle—as used for receiving signals from space craft because of its vastly improved signal to noise ratio. Provides fantastic results even in difficult areas. Tuning range 87·5 to 108MHz. Automatic stereo indicator. Sensitivity: 2uV. AFC range ± 200KHz. Signal to noise ratio: 65dB. Output voltage 2 × 150mV. Operating voltage 25–30V. D.C. Size: 93 × 40 × 207 mm. REC. LIST PRICE £25.

OUR PRICE ONLY £15·75 P. & P. 25p

Unrepeatable offer—buy now and save over £9

SINCLAIR EQUIPMENT

Project 60. Package offers.

2 x Z30 amplifier, stereo 60 pre-amp, PZ5 power supply. **£15·95** Carr. 37½p. Or with PZ6 power supply **£18·00** Carr. 37½p. 2 x Z50 amplifier, stereo 60 pre-amp, PZ8 power supply. **£20·25.** Carr. 37½p.
Transformer for PZ8. **£2·97½** extra.
Add to any of the above **£4·45** for active filter unit and **£13·80** for pair of Q16 speakers.
Project 60 FM Tuner **£15·75.** Carr. 37½p.
All other Sinclair products in stock.
2000 Amp **£21·95** Carr. 37½p.; 3000 Amp **£28.50** Carr. 37½p.: Neoteric Amp **£43·95** Carr. 37½p IC12 **£1·80** Post 10p
PROJECT 605 — **£20·97,** Carr. 37p.

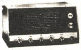
WHARFEDALE MID-RANGE HI-FI UNITS

As used in world famous system. 5" dia. Impedance 4/8 ohms. High flux ceramic magnet. 20 watts rms. Brand new **£1·50.** Carr. 37p.

UNR-30 RECEIVER

4 Bands covering 550kc/s-30 mc/s. B.F.O. Built-in Speaker 220/240v. A.C. Brand new with instructions. **£15·75.** Carr. 37½p.

LAFAYETTE HA-600 SOLID STATE RECEIVER



General coverage 150–400kc/s, 550 kc/s–30mc/s. FET front end. 2 mech. filters, product detector, variable B.F.O., noise limiter, S. Meter, Bandspread. RF Gain. 15" x 9¾" x 8¼". 18 lbs. 220/240v. A.C. or 12v. D.C Brand new with instructions. **£50.** Carr. 50p.

TE-65 VALVE VOLTMETER

High quality instrument with 28 ranges. D.C.volts 1·5–1,500v. A.C. volts 1·5—1,500v. Resistance up to 1,000 megohms. 200/240v. A.C. operation. Complete with probe and instructions.
£17·50. P. & P. 30p
Additional probes available: R.F. **£2·12½**; H.V **£2·50.**

POWER RHEOSTATS

High quality ceramic construction. Windings embedded in vitreous enamel. Heavy duty brush wiper. Continuous rating. Wide range ex-stock. Single hole fixing, ¼in. dia. shafts. Bulk quantities available.

25 WATT. 10/25/50/100/250/500/1000/1500/2500 or 5000 ohms, **90p,** P. & P. 7½p.
50 WATT. 10/25/50/100/250/500/1000/2500 or 5000 ohms, **£1·15** P. & P. 7½p.
100 WATT. 1/5/10/25/50/100/250/500/1000 or 2500 ohms, **£1·65** P. & P. 7½p.

"YAMABISHI" VARIABLE VOLTAGE TRANSFORMERS

Excellent quality . Low price . Immediate delivery

S-260 General Purpose Bench Mounting

1 Amp	£7·00
2.5 Amp	£8·05
5 Amp	£11·75
8 Amp	£15·90
10 Amp	£22·50
12 Amp	£23·60
20 Amp	£49·00

S-260B Panel Mounting

1 Amp	£7·00
2.5 Amp	£8·05

Please add postage
ALL MODELS
INPUT 230 VOLTS,
50/60 CYCLES,
OUTPUT VARIABLE
0–260 VOLTS.
Special discounts for quantity

G.W.SMITH & CO.(RADIO) LTD

10 TOTTENHAM CT. RD. LONDON, W.1 Tel: 01-637 2232
27 TOTTENHAM CT. RD. LONDON, W.1 Tel: 01-636 3715
257/258 TOTTENHAM CT. RD. LONDON, W.1 Tel: 01-580 0670
3 LISLE STREET, LONDON, W.C.2 Tel: 01-437 8204
34 LISLE STREET, LONDON, W.C.2 Tel: 01-437 9155
~~311 EDGWARE ROAD, LONDON, W.2 Tel: 01-262 0387~~

CALLERS WELCOME MONDAY TO SATURDAY 9AM-6PM

All Mail Orders to –
11-12, Paddington Green,
London, W.2
Tel: 01-262 6562

ENGINEERS!

WRITE FOR THE BOOK THAT CAN CHANGE YOUR WHOLE FUTURE

The BIET Guide to Success should be read by every ambitious engineer.
Do you want promotion, a better job, higher pay? "New Opportunities" shows you how to get them through a low-cost BIET Home Study Course. There are no books to buy and you can pay-as-you-learn. Send for this helpful 76 page FREE book now. No obligation and nobody will call on you. It could be the best thing you ever did.

CHOOSE A NEW FUTURE NOW!

MECHANICAL
A.M.S.E. (Mech)
C & G Eng. Crafts
C & G Fabrication
Diesel Eng.
Inst. Eng. & Tech.
Inst. Motor Ind.
Maintenance Eng.
Mechanical Eng.
Sheet Metal Work
Welding

ELECTRICAL & ELECTRONIC
A.M.S.E. (Elec.)
C & G Elec. Eng.
C & G Elec. Inst.
C & G Elec. Tech.
Computer Elec.
Electronic Eng.
Electrical Eng.
Install. & Wiring

MANAGEMENT & PRODUCTION
Computer Prog.
Electronic Data Processing
Estimating
Foremanship
Inst. Cost & Works Accountants
Inst. Marketing
Management
Motor Trade Man.
Network Planning
Personnel Man.
Production Eng.
Quality Control
Salesmanship
Storekeeping
Work Study
Works Management

DRAUGHTSMANSHIP
A.M.I.E.D.
Electrical Draughtsmanship
Gen. Draughtsmanship
Jig & Tool Design
Technical Drawing

RADIO & TELECOMMUNICATIONS
C & G Radio/TV/Electronics
C & G Telecomm. Technicians
Prac. Radio & Elec. (with kit)
Radio Amateurs Exam.
Radio Servicing & Repairs
Transistor Course
TV Main. & Serv.

AUTO & AERO
Aero Eng.
A.M.I.M.I.
A.R.B. Cert.
Auto Engineering
Auto Repair
C & G Auto Eng.
Garage Management
MAA/IMI Diploma
Motor Vehicle Mechanics

CONSTRUCTIONAL
A.M.S.E. (Civil)
Architecture
Building
Carpentry & Joinery
Civil & Municipal Eng.
Constructional Eng.
Construction Surveyors Institute
Clerk of Works
Council Eng.
Health Eng.
Heat & Vent.
Hydraulics
Inst. of Builders
Inst. Clerk of Works
Inst. Works & Highway Supers.
Painting & Decorating
Structural Eng.
Surveying

GENERAL
Agricultural Eng.
Council of Eng. Inst.
General Education
Pract. Slide Rule
Pure & Applied Maths
Refrigeration
Rubber Technology
Sales Engineers
University Ent.

G.C.E. 58 'O' & 'A'
LEVEL SUBJECTS
Over 10,000
Group Passes

SEND FOR YOUR FREE BOOK NOW!

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY B129

To B.I.E.T. Dept. XXX
Aldermaston Court
Reading RG7 4PF

Please send me book and details of your courses in:

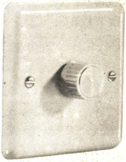
BIET

NAME ______________________________
BLOCK CAPITALS PLEASE
ADDRESS ______________________________

SUBJECT OF INTEREST ______________________ AGE ________

Accredited by the Council for the Accreditation of Correspondence Colleges. **B129**

Vary the strength of your lighting with a DIMMASWITCH



The DIMMASWITCH is an attractive and efficient dimmer unit which fits in place of the normal light switch and is connected up in exactly the same way. The white mounting plate of the DIMMASWITCH matches modern electric fittings. Two models are available, with the bright chrome knob controlling up to 300 w or 600 w of all lights except fluorescents at mains voltages from 200-250 v, 50Hz. The DIMMASWITCH has built-in radio interference suppression:

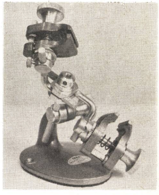
600 Watt – **£3·20.** Kit Form **£2·70**
300 Watt—**£2·70.** Kit Form **£2·20**

All plus 10p post and packing.
Please send C.W.O. to:—

DEXTER & COMPANY
5 ULVER HOUSE, 19 KING STREET,
CHESTER CH1 2AH Tel: 0244-25883

As supplied to H.M. Government Departments.

The New Styled "MULTI-MINI" TWIN-VICES



*An extra **"Pair of hands"** for those tricky jobs*

ASSEMBLY—SOLDERING—GLUING—WIRING—DRILLING ETC.

- INDEPENDENT ADJUSTMENT OF THE TWO VICE HEADS TO ANY ANGLE WITH POSITIVE LOCKING.
- JAWS WILL FIRMLY GRIP, ROUND, FLAT, SQUARE, OR HEXAGONAL PARTS.

TWIN VICE: £8·95 (25p P. & P.)
Also available
SINGLE VICE: £5·45 (21p P. & P.)

CANLEY ENGINEERING (SALES) LTD. DEPT. C/E1
OSBORNE ROAD, COVENTRY CV5 6EA
TEL: (0203)-77163/4.

BI-PRE-PAK

COMPLETE TELEPHONES

EX. G.P.O. NORMAL
HOUSEHOLD TYPE

ONLY 95p

POST & PACKING 35p EACH

TELEPHONE DIALS

Standard Post Office type. Guaranteed in working order.

ONLY 50p

POST & PACKING 15p

TESTED AND GUARANTEED PAKS

B2	4	Photo Cells, Sun Batteries. 0·3 to 0·5V. 0·5 to 2mA.	50p
B79	4	IN4007 Sil. Rec. diodes. 1,000 PIV lamp plastic	50p
B81	10	Reed Switches, mixed types large and small	50p
B99	200	Mixed Capacitors. Approx. quantity, counted by weight	50p
H4	250	Mixed Resistors. Approx. quantity counted by weight	50p
H7	40	Wirewound Resistors. Mixed types and values.	50p
H40	20	BFY50/2, 2N696, 2N1613 NPN Silicon uncoded TO5	50p
H9	2	OCP71 Light Sensitive Photo Transistor	50p
H39	10	Integrated Circuits. 6 Gates BMC 962, 4 Flip Flops BMC 945	50p
H28	20	OC200/1/2/3 PNP Silicon uncoded TO-5 can	50p
H30	20	1 Watt Zener Diodes, Mixed Voltages 6.8 – 43V.	50p
H35	100	Mixed Diodes, Germ. Gold bonded, etc. Marked and Unmarked.	50p
H38	30	Short lead Transistors, NPN Silicon Planar types.	50p

UNMARKED UNTESTED PACKS

B66	150	Germanium Diodes Min. glass type	50p
B83	200	Trans. manufacturers' rejects all types NPN, PNP, Sil. and Germ.	50p
B84	100	Silicon Diodes DO-7 glass equiv. to OA200, OA202	50p
B86	50	Sil. Diodes sub. min. IN914 and IN916 types	50p
B88	50	Sil. Trans. NPN, PNP equiv. to OC200/1 2N706A, BSY95A, etc.	50p
B1	50	Germanium Transistors PNP, AF and RF	50p
H6	40	250mW. Zener Diodes DO-7 Min. Glass Type	50p
H17	20	3 amp. Silicon Stud Rectifiers, mixed volts	50p
H15	30	Top Hat Silicon Rectifiers, 750mA. Mixed volts	50p
H16	15	Experimenters' Pak of Integrated Circuits. Data supplied	50p
H20	20	BY126/7 Type Silicon Rectifiers 1 amp plastic. Mixed volts.	50p
H34	15	Power Transistors, PNP, Germ. NPN Silicon TO-3 Can.	50p

MAKE A REV COUNTER FOR YOUR CAR

The 'TACHO BLOCK'. This encapsulated block will turn any 0-1mA meter into a linear and accurate rev. counter for any car with normal coil ignition system.

£1 each

OUR VERY POPULAR 3p TRANSISTORS

TYPE "A" PNP Silicon alloy, TO-5 can.
TYPE "B" PNP Silicon, plastic encapsulation.
TYPE "E" PNP Germanium AF or RF.
TYPE "F" NPN Silicon plastic encapsulation.

FULLY TESTED AND MARKED SEMICONDUCTORS

	£p		£p
AC107	0·15	OC139	0·13
AC126	0·15	OC140	0·15
AC127	0·17	OC170	0·23
AC128	0·15	OC171	0·23
AC176	0·20	OC200	0·25
ACY17	0·20	OC201	0·25
AF239	0·30	2N1302-3	0·15
AF186	0·20	2N1304-5	0·17
AF139	0·30	2N1306-7	0·20
BC154	0·20	2N1308-9	0·22
BC107	0·10	2N3819FET	0·40
BC108	0·10	2N4416FET	0·35
BC109	0·10	**Power Transistors**	
BC148	0·10		
BC169	0·12	OC20	0·40
BF194	0·15	OC23	0·25
BF274	0·20	OC25	0·25
BFY50	0·15	OC26	0·25
BSY25	0·13	OC28	0·30
BSY26	0·13	OC35	0·25
BSY27	0·13	OC36	0·37
BSY28	0·13	AD149	0·35
BSY29	0·13	AUY10	0·75
BSY95A	0·10	2S034	0·25
OC41	0·15	2N3055	0·40
OC44	0·13	**Diodes**	
OC45	0·10	AAY42	0·10
OC71	0·10	OA95	0·07
OC72	0·10	OA79	0·07
OC81	0·13	OA81	0·07
OC81D	0·13	OA95	0·07
OC83	0·18	IN914	0·06

POWER TRANSISTOR PRICE BREAKTHROUGH!

Plastic cased Silicon Power Transistors of latest design. 40watts and 90watts. PNP & NPN types. All types available at the most shatteringly low prices of all time. All are fully tested, marked and guaranteed!

	1-12	13-25	26-50
40W NPN	20p	18p	16p
40W PNP	21p	19p	17p
90W NPN	24p	22p	20p
90W PNP	25p	23p	21p
PAK PAKS of matched pairs			
MP40 40W + 40W	50p	48p	26p
MP90 90W + 90W	60p	58p	56p

A CROSS HATCH GENERATOR FOR £3.50 ! ! !

YES, a complete kit of parts including Printed Circuit Board. A four position switch gives X-hatch, Dots, Vertical or Horizontal lines. Integrated Circuit design for easy construction and reliability. This is a project in the September edition of Practical Television.

This complete kit of parts costs £3.50, post paid.

A MUST for Colour T.V. Alignment.

Our famous P1 Pak is still leading in value for money.

Full of Short Lead Semiconductors & Electronic Components, approx. 170. We guarantee at least 30 really high quality factory marked Transistors PNP & NPN, and a host of Diodes & Rectifiers mounted on Printed Circuit Panels. Identification Chart supplied to give some information on the Transistors.

Please ask for Pak P.I. Only 50p.
10p P & P on this Pak.

FREE CATALOGUE FOR

TRANSISTORS, RECTIFIERS, DIODES, INTEGRATED CIRCUITS, FULL PRE-PAK LISTS

8 RELAYS FOR VARIOUS TYPES £1

P & P 25p

INTEGRATED CIRCUITS

		1-12	13-25	26-50
Clocked Flip Flop	BMC931	20p	18p	16p
Ex. 2/4-input Buffer	BMC932	12p	11p	10p
2/4-input Expander	BMC933	12p	11p	10p
Hex. Inverter	BMC934	12p	11p	10p
Hex. Inverter	BMC935	12p	11p	10p
Hex. Inverter	BMC936	12p	11p	10p
Hex. Inverter	BMC937	12p	11p	10p
Decade Counter	BMC938	25p	23p	21p
Div. by 16 Counter	BMC939	25p	23p	21p
Hex. Inverter	BMC940	12p	11p	10p
Hex. Inverter	BMC941	12p	11p	10p
Type D Flip Flop	BMC942	20p	18p	16p
Ex. 2/4-input Power	BMC944	12p	11p	10p
Clocked Flip Flop	BMC945	20p	18p	16p
Quad Inverter	BMC946	11p	10p	9p
Clocked Flip Flop	BMC948	20p	18p	16p
Quad Inverter	BMC949	12p	11p	10p
Pulsed Trig. Binary	BMC950	20p	18p	16p
Monostable Multivib.	BMC951	25p	23p	21p
Dual J/K Flip Flop	BMC953	20p	18p	16p
Dual J/K Flip Flop	BMC955	20p	18p	16p
Dual J/K Flip Flop	BMC956	20p	18p	16p
Quad. 2-input Power	BMC958	12p	11p	10p
2/4-input Gate	BMC961	12p	11p	10p
3/3-input NAND Gate	BMC962	11p	10p	9p
3/3-input NAND Gate	BMC963	12p	11p	10p
Audio Amp. 3w.	SL403D	£1·50	£1·40	£1·36
Linear Op. Amp	709C	25p	20p	15p
Decade Counter	SN7490	65p	60p	55p

LOW COST DUAL IN LINE I.C. SOCKETS

14 pin type at 15p each } Now new low profile
16 pin type at 16p each. } type

BOOKS

We have a large selection of Reference and Technical Books in stock.
These are just two of our popular lines:

B.P.I Transistor Equivalents and Substitutes; **40p**
This includes many thousands of British U.S.A., European and C.V. equivalents.
Postage and Packing 21p.

The Iliffe Radio Valve & Transistor Data Book 9th Edition; **75p**
Characteristics of 3,000 valves and tubes, 4,500 Transistors, Diodes, Rectifiers and Integrated Circuits.
Send for lists of these English publications.

Please send me the FREE Bi-Pre-Pak Catalogue.

NAME...

ADDRESS ....

....

MINIMUM ORDER 50p. CASH WITH ORDER PLEASE. Add 10p post and packing per order OVERSEAS ADD EXTRA FOR POSTAGE

BI-PRE-PAK LTD

DEPT. D, 222-224 WEST ROAD, WESTCLIFF-ON-SEA, ESSEX SS0 9DF
TELEPHONE: SOUTHEND (0702) 46344

everyday electronics PROJECTS.. THEORY.....

A GOOD QUESTION

But what, actually, is the difference between *electronic* and *electrical?* Almost certainly every reader has either posed this very question or has had to supply the answer, sometime or another.

Seeing that electric current is the energy involved in both electronic and electrical devices and systems, the puzzlement and confusion existing in many minds is quite understandable. Yet there is a clearly definable difference between these two branches of science and engineering, closely related as undeniably they are.

THE DIFFERENCE

Electrical apparatus and systems depend upon electric current produced by the drift of electrons within metallic conductors—"conventional" electricity, in other words.

The whole science and technology of *electronics* is based upon the special properties of certain devices such as the valve and, more importantly today, the semiconductor. In such devices the conduction of electric current takes place either through a vaccum or gas—as in the case of the valve, or by a somewhat abstruse process involving the movement of both negative and positive "current carriers" within the confines of a semiconductor material. The special properties and characteristics of these "electronic" devices make all of electronics possible.

Historically, electronics owes its original development as a separate branch of technology, quite distinct from electrical engineering, to the exceptional capabilities of the valve. This device has largely fallen into disuse since the arrival of the modern semiconductor. The latter has "taken over" and greatly enhanced the possibilities and, thereby the prestige, of electronics.

GROUND WORK

Any study of electronics clearly involves examining how these vital electronic devices work and the manner in which they can be applied to produce various useful functions through different circuit arrangements. However, a prerequisite to such study is a good general knowledge of the related subject, electricity. With this knowledge one can confidentally tackle the more intricate (and more exciting) matters that are part and parcel of electronics.

From enquiries we receive it is evident that a straightforward explanation of electrical theory would be welcomed by many beginners, as a prelude to their immersion in genuine electronics. We are therefore commencing this month a new six-part series entitled *Basic Electricity*. Although aimed primarily at those starting from scratch, this series could provide a useful "recap" of the subject for many others.

Fred Bennett.

Our December issue will be published on Friday, November 17

EDITOR F. E. BENNETT • ASSISTANT EDITOR M. KENWARD • B. W. TERRELL B.Sc.
ART EDITOR J. D. POUNTNEY • P. A. LOATES • S. W. R. LLOYD
ADVERTISEMENT MANAGER D. W. B. TILLEARD

© IPC Magazines Limited 1972. Copyright in all drawings, photographs, and articles published in EVERYDAY ELECTRONICS is fully protected, and reproduction or imitations in whole or part are expressly forbidden.

All reasonable precautions are taken by EVERYDAY ELECTRONICS to ensure that the advice and data given to readers are reliable. We cannot, however, guarantee it, and we cannot accept legal responsibility for it. Prices quoted are those current as we go to press.

Subscription Rates including postage for one year, to any part of the world, £2·35.
Everyday Electronics, Fleetway House, Farringdon Street, London, E.C.4. Phone: *Editorial* 01-634-4452; *Advertisements* 01-634-4202.

. EASY TO CONSTRUCT
. SIMPLY EXPLAINED

VOL. I NO. 13

NOVEMBER 1972

CONSTRUCTIONAL PROJECTS

AUTO ACCELEROMETER *Check the performance of your car* by Brice Ward 696
ELECTRONIC GUITAR *Beta construction, for use in conjunction with the blueprint* by B. W. Terrell 710
TRANSISTOR TESTER *Provides a quick check of most transistors* by P. A. Graves 718

GENERAL FEATURES

EDITORIAL 694
SHOP TALK *Components and new products* by Mike Kenward 701
RADIO CONTROL OF MODELS *The state of the art* 702
ACTION! *A look at an electronics evening class* 707
GUIDE TO CIRCUIT SYMBOLS *Part 5—Transducers, Semiconductors* 708
PLEASE TAKE NOTE 714
BASIC ELECTRICITY *Part I—Batteries* by Maureen Birch 715
RUMINATIONS by Sensor 717
THEY MADE THEIR MARK *No. 6 Faraday (Part 2)* by J. E. Gregory 722
TEACH-IN END OF TERM ANSWERS *Answers to last month's test* 725
READERS LETTERS *Comment and criticism from you* 726

★ **FREE BLUEPRINT for ELECTRONIC GUITAR**

EE binders...

Both volume 1 and volume 2 (Jan. to Dec. 73) Easi-Binders are now available—handsomely finished in orange de luxe Balacron with black lettering on the spine.
Order your binder from Binding Dept., IPC Magazines Ltd., Carlton House, 68, Great Queen Street, London W.C.2.
The price is 88p, including postage and packing.

AUTO

An instrument to test overall car performance.

EVERY driver interested in his automobile performance would probably like to have a Dynamometer available for testing performance but this would cost more than it would be worth.

There are low cost instruments for checking timing, contact breaker point dwell time and similar items but generally, these do not measure the overall performance of an automobile.

But utter simplicity quite frequently offers an answer which was unsuspected and that is the case with the Auto Accelerometer! Without measuring horsepower it does succeed in giving an indication of overall performance by measuring both acceleration and deceleration.

Increased acceleration obtained by adjusting carburation or timing indicates an increase in horsepower delivered to the rear wheels and a measurement of deceleration can be a good indicator of brake condition, road holding and brake fade.

In one small, simple instrument, we have the capability of measuring a wide range of performance parameters for the automobile.

For the avid enthusiast, it offers a means of checking the total effect of various changes in timing, carburettors, ignition systems and the like while for the not so avid, it furnishes a means of correcting bad driving habits and generally monitoring performance.

PRINCIPLES OF OPERATION

Acceleration is normally measured in "g's." Speed is a measure of distance travelled per unit of time while acceleration is a measure of the change in speed per unit of time. The first is expressed as feet per second or miles per hour and the second in feet per second per second or miles per hour per second so that what is actually being measured is the number of miles per hour increase in speed per second.

The g, taken from the word gravity, is an international unit defined as the acceleration produced on a dropped object by the earth's gravitational field. In actual figures an acceleration of 1g is equal to 32·2 feet per second per second or 22 miles per hour per second.

A pendulum responds in a very precise way to the effects of acceleration at right angles to the surface of the earth. That precise relationship says that the tangent of the angle from the vertical assumed by the pendulum equals the acceleration!

If the pendulum assumes a 45 degree angle from the vertical, the tangent of 45 degrees equals 1 and the acceleration is thus 1g. Deceleration is determined in the same general way.

The actual sensing device in the accelerometer is a simple potentiometer (VR3) with turning friction reduced to a minimum. There are any number of more complex ways to make a sensing device but this is by far the most straight forward. To this potentiometer is added a pendulous weight that will turn the potentiometer under acceleration and return to a known resting point with minimum hysteresis.

CIRCUIT DESCRIPTION

The circuit (Fig. 1) is a simple bridge that is

Approximate cost of components £4·50 inclusive

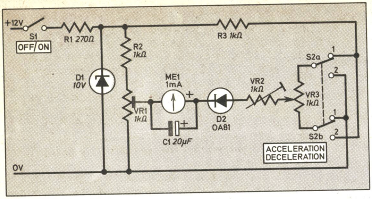


Fig. 1. Complete circuit diagram of the Auto Accelerometer. The pendulum which senses acceleration or decelaration is affixed to the shaft of potentiometer VR3.

balanced to give a zero reading on ME1 with preset VR1. The pendulum is attached to the shaft of potentiometer VR3 and as it pivots the circuit is unbalanced. Potentiometer VR2 is used to set the meter for full scale deflection with the pendulum at 45 degrees from the vertical (simulating 1g).

Diode D2 prevents reverse current through the meter and could be eliminated with very little chance of damaging the meter; it does prevent reverse deflection. Capacitor C1 eliminates any very fast fluctuations in the needle reading.

Power is obtained from the automobile battery and is regulated by R1 and D1 to approximately 10 volts.

THE PENDULOUS WEIGHT

A simple weight can be made of solder or plumbing lead. A chipboard box will smoke when the weight is cast but can be used as a one time mould for this job. A brass bush that will fit on the spindle of the potentiometer used, should be obtained. Clean this bush with sandpaper and flux it with some liquid flux. Insert it in the corner of the mould made as illustrated in Fig. 2.

Melt the solder or lead in a suitable container and pour it into the mould. Allow a few minutes

ACCELEROMETER

By Brice Ward

AUTO ACCELEROMETER

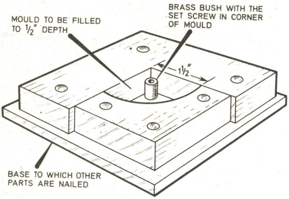

MOULD TO BE FILLED TO $1/2''$ DEPTH
BRASS BUSH WITH THE SET SCREW IN CORNER OF MOULD
$1\frac{1}{2}''$
BASE TO WHICH OTHER PARTS ARE NAILED

Fig. 2. The mould used to form the pendulous weight.

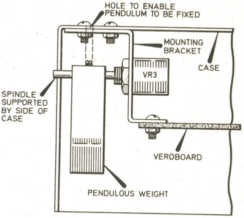

HOLE TO ENABLE PENDULUM TO BE FIXED
MOUNTING BRACKET
VR3
CASE
SPINDLE SUPPORTED BY SIDE OF CASE
VEROBOARD
PENDULOUS WEIGHT

Fig. 3. Mounting of VR3, the pendulum and the Veroboard.

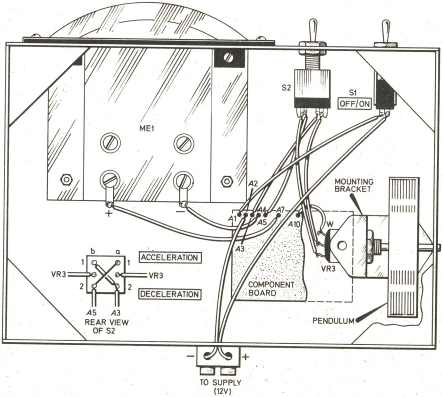


Fig. 5. Layout and wiring of the complete unit.

for the mass to cool and then, if you are satisfied with the results, quench it under cool water.

The potentiometer used for VR3 should be one of the types having a nylon spindle and should rotate freely with very little friction. Install a bracket on the potentiometer bush that is long enough to allow the pendulum clearance to turn (see Fig. 3).

The pendulum can now be attached to the shaft with the setscrew in the bush and the bracket fixed inside the case. A hole in the top of the case will allow adjustment of the pendulum after assembly.

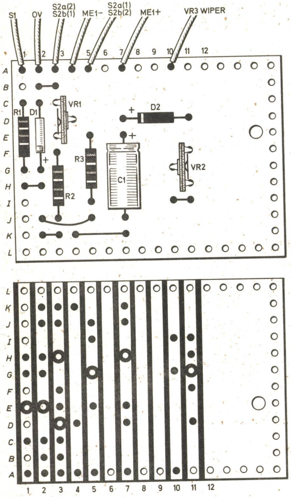
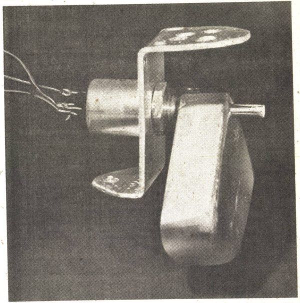


Fig. 4. Layout and wiring of the Veroboard. Copper strips to the right of strip 11 are not used and have not been indicated.

FINAL CONSTRUCTION

The layout and wiring of the Veroboard is shown in Fig. 4. After cutting the Veroboard to size and cutting the conductors as illustrated, install and solder the components and wires required.

Final assembly is illustrated in Fig 5. An edgewise type meter is used, mounted in one side of the case. The electronics can be installed anywhere in the case. Make sure that the diodes and capacitor are placed the right way around and take care not to overheat the diodes when soldering.



The pendulum mounted on VR3 together with the bracket.

Components....

SEE
SHOP
TALK

Resistors

R1	270Ω
R2	1kΩ
R3	1kΩ
All ± 10% ¼W carbon	

Capacitor

C1	20μF elect. 12V

Potentiometers

VR1	1kΩ skeleton preset (or normal carbon —see text)
VR2	1kΩ skeleton preset
VR3	1kΩ linear carbon (see text)

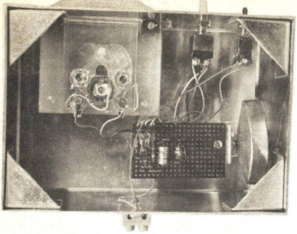
Diodes

D1	10V 400mW Zener
D2	OA81

Miscellaneous

ME1	1mA moving coil meter (any shape)
S1	S.p.s.t. toggle switch
S2	D.p.d.t. toggle switch

Veroboard 1·7 x 1·3 x 0·1 in. matrix, plumbers lead or bar type solder for pendulum, 6in. x 4in. x 2½in. aluminium chassis for case VR3 mounting bracket, two way connector, 4BA fixings, connecting wire, brass bush ½ in. long to fit on VR3 spindle with a set screw.



Internal view of the prototype unit showing the positions of components and the pendulum.

TESTING

Connect a source of 12 volts d.c. to the system observing lead polarity. If not done previously, adjust preset VR1 so that it is about half way around its range. Now adjust the pendulum on the shaft of VR3 so that it is hanging straight down with the meter reading zero.

Using a 45 degree set square or a protractor, incline either the base of the case or the pendulum to 45 degrees and adjust VR2 for full scale deflection on the meter.

Since the diode (D2) introduces some non-linearity, it would be a good idea to make a calibration chart by inclining the pendulum to the angles illustrated in Table 1 and noting the meter reading at these angles. It is worth noting that a germanium diode, as specified, will introduce less error than a silicon diode, due to the forward voltage drop being less in a germanium device.

INSTALLATION

Finally, install the unit, ensure that the shaft of the potentiometer is at right angles to the direction of travel of the automobile, that the unit is level and the meter is installed where it can be seen. Connect the unit to the car supply observing polarity and switch on. The unit is now ready for road testing but before starting these tests, **be certain that they can be performed with complete safety.**

Table 1: Calibration Chart

Acceleration in g	Angle in degrees	Meter Reading
0	0	0
0·1	6	
0·2	11	
0·3	17	
0·4	22	
0·5	26·5	
0·6	31	
0·7	35	
0·8	38·5	
0·9	42	
1·0	45	1·0

ROAD TESTING

A navigator should be called on to read the meter. With the accelerometer set for acceleration, have the navigator note the reading at regular intervals (say every 5 m.p.h.) as you accelerate in first gear. Then do the same for the rest of the gears. It is best to make these tests on a flat road and running in both directions

The plotted results should be a curve something like the one in Fig. 6. The crossover points indicate the best gear change point in miles per hour for each gear. For example, the shift from first to second gear should be at about 32-33 miles per hour for this curve. If the car is fitted with a rev counter these points could be noted in revs per minute.

Testing the brakes can be done in the deceleration position of switch S2. It may be necessary to readjust VR1 which might also be mounted as a potentiometer on the front panel to allow for quick readjustment if required.

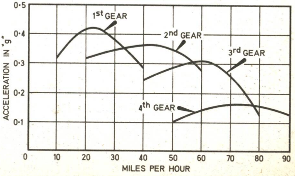
Drum brakes should indicate at least 0·5g and disc brakes from 0·7 to as high as 0·9g.

Brake fade can be tested by making a repetitive series of hard stops from 40 miles per hour and comparing all the results. The results may surprise you.

The unit can also be used to correct bad driving habits. On a level motorway, for example, at a set speed, the meter needle should sit rock steady at zero. If it does not, you are in all probability operating the accelerator pedal without realising it.

The effects of motor oil can be checked. Oil can, if viscous enough, cause a considerable amount of drag and changing to another oil can help. Tyre pressure, open windows and many other things can contribute to drag and the effects can be assessed with the accelerometer.

Fig. 6. The graph resulting from the road tests mentioned in the text. The best gear change points occur where the graphs cross.



SHOP TALK

By Mike Kenward

HOPEFULLY we will be addressing a few new readers this month. With the commencement of the *Basic Electricity* series we hope to gradually introduce some new readers into the ways of constructional electronics. Although this page may not be of great interest to the very new beginners who may not be buying many "electronic" components just yet, they will no doubt be keen to find out about general supply problems and of course some of the new products mentioned are sure to warrant attention.

Having said that, we must point out that we do not supply components, only the written word! If you have a component supply shop near you they should be able to supply most of the components we use. For the special components, or if there are no supply shops near where you live, you will have to send for the parts to one of the many mail order firms who advertise in our pages.

Basic Electricity

All the components needed for the first part of *Basic Electricity* are obtainable from Woolworths or most good electrical shops (excepting the pencil). Just one word of warning, if you want to cut up some old batteries to see just what is inside, make sure you do it on plenty of newspaper because it can be a very messy process.

Beta Electronic Guitar

As you will see from the article about *Beta* most of the requirements this month are for the wooden parts, generally available from timber yards—cut to size and shape if you are lucky (see text).

Other parts needed for the construction detailed this month are the six single machine heads, a six-string adjustable bridge, about four feet six inches of standard fret wire, two strap fasteners and a strap. When buying the machine heads make sure you get three left hand and three right hand ones, all these parts should be available from a good guitar shop.

We never cease to surprise ourselves at what can be used in building various projects, in the past we have specified egg cups and denture cleaning tablet tubes, now we use two knitting needles —or better still, as you only have to buy one at a time, two crochet needles. These needles are used to form the finger position markers on the *Beta* fretboard, the sizes required are No 5 and No 7. Make sure you get plastic ones of the colour you require.

Auto Accelerometer

Most of the parts for the *Auto Accelerometer* are readily available. The meter does not have to be of the edgewise type shown but this type does provide a compact, neat-looking finished unit. The prototype case is a standard aluminium chassis, available from some of our advertisers.

One point to watch is the type of potentiometer obtained for VR3. We recommend the plastic spindle type for this job as they are usually reasonably frictionless.

Solder to make the pendulum can be bought in rods—a garage or hardware shop will sell you this. Do not attempt to use multicore solder as you will find it very expensive.

Transistor Tester

An extremely useful, simple project that will probably be put to good use by many readers, the *Transistor Tester* therefore deserves a sturdy case and we recommend the diecast type as used in the prototype. With a coat of paint this case is quite presentable and very strong. No real problems concerning components for this project, the Terry clip used to hold B1 should be available at most hardware stores.

New Products

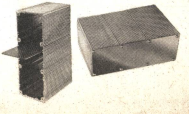
Once again some interesting new products have found their way into our offices, one of which is of particular interest to us since a similar product ceased to be made some time ago. This product is called Norman Q-Strip and is what we have previously termed stick down wiring.

Q-Strip is a $\frac{1}{8}$ inch wide strip of copper with a thermo-setting adhesive on one side. After a protective backing is peeled off the copper is glued to a piece of component mounting board and used to form a circuit, in a similar way to a printed circuit board.

Having tested some Q-Strip in our workshop we have found the adhesive to be good even after two or three "re-heats". The strip can also be stuck down if it is accidentally lifted during desoldering. At 18p for 40 inches this circuit strip should be popular. Available from most large component suppliers in the near future.

We are always receiving enquiries about cases and various mounting and component housing problems for many of our projects. One new type of case which should go a long way to help with many of these problems has recently been announced by Vero Electronics Ltd. (the Veroboard people). The case—called Verobox—is made in various sizes from extruded aluminium sections, each incorporating two circuit board or chassis mounting strips. The extruded sections interlock and are held together by plain end plates and self-tapping screws. Altogether 80 different size cases are available ranging from 58 × 58 × 25 mm to 208 × 208 × 200 mm.

The finish of the extruded sections is exceptional and the prices range from approximately 40p to over £4. The Veroboxes should be available from most large suppliers.



Radio

By A.J. Dunn

In amateur electronics there are very few truly redundant components; the odd transformer, capacitor or even a piece of wire is harboured against the day when it can be employed profitably, lest the mere act of throwing it away will evoke a well known law and a replacement will have to be purchased. It is not unusual therefore to find the radio control enthusiast still employing parts of equipment that has long been outmoded.

This article is intended to familiarise the beginner with components and published information against the historical background of radio control and to outline the scope of the hobby.

HISTORY

Radio control is almost as old as radio itself but it had little practical meaning until the late 1940's; there were of course, controlled models before the war and in America a radio controlled model aircraft contest, but in general it was a field in which only the intrepid and stalwart could succeed. There were three reasons for this —the high relative cost, the uncertainty of operation and what may be described as a psychological barrier.

The type of mind necessary for the painstaking construction of a delicate model was not often coupled with the brash inquisitiveness necessary

Control of Models

for the development of the electronics—indeed it was often found that a good modeller joined forces with the local radio enthusiast to ensure success.

It was necessary to use an expensive special gas filled valve called "miniature". The valve had a very limited life and it called for great skill to adjust the circuit to maintain the maximum sensitivity without the valve taking excess current, leading to early demise.

Ferrite was a thing of the future so all coils were on hand-made formers, capacitors were often part-fabricated to save weight and high voltage batteries produced from copper and zinc sheet similar to Zamboni Piles. The electronics finished at the point where the (hand-made) relay closed in sympathy with the on-off switch on the transmitter, but then the electrics started.

In order to control various functions of the model, electro-mechanical sequential systems were devised—peculiar, delicate and often fiendishly ingenious assemblies of bent tin and tiny coils using twisted rubber bands as "motors". There was no weight restriction on the transmitter design so these tended to be large; the power source being an accumulator and 120 volt batteries. There was no question of the transmitter being hand-held!

TRANSISTORS

Post war modellers with a developed knowledge of electronics soon set higher standards of performance and the advent of the early transistors enabled them to develop systems superior to, and thereby displace, some of the commercially available equipment.

Instead of simply interrupting the transmitter output (interrupted carrier wave) the r.f. output was modulated (Fig. 1) with low frequency audio tones (modulated carrier wave) either sequentially or simultaneously. Either method was easy to apply to the transmitter but the difficulty lay in separating out the tone information in the receiver. Two methods were used, each "tone" had an associated filter assembly and subsequent amplifier and relay or alternatively a "reed bank" or "reed relay" was used.

The reed bank is the equivalent of a number of relays each with a mechanically tuned attraction plate in the form of a long, thin, springy strip which vibrates as in a tuning fork. Each reed of the composite device is fitted with a miniature adjustable contact and when the appropriate frequency is applied the reed vibrates in resonance and makes repeated momentary contact.

The problem of momentary contact is easily overcome but the current rating of the miniature contacts necessitates a further "slave" relay (or transistor switch) for each reed or tone channel, capable in turn of carrying the current required by the actuator coils.

The device works very well indeed but needs great precision in manufacture and is consequently expensive, accounting for approximately half the cost of an installation, and is relatively heavy.

CONTROL SYSTEMS

The experienced modeller can make a model perform quite complex evolutions even with a system that can only give instructions such as

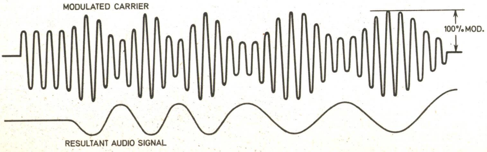


Fig. 1. Showing low frequency modulation of the r.f. carrier wave.

turn left—turn right: in a sense he achieves a degree of proportional control by varying the time ratio of the two instructions so that the mean effect produces a result approximately correct; an aeroplane, for example, can be flown in a multi-cornered circle. Possibly the best example of this practice, still in vogue, is the "galloping ghost".

Despite the proven reliability of the reed bank its weight and cost led experimenters to use compact ferrite-cored filter units from which a d.c. output can be derived as a function of a parameter change of the transmitter tone. This "controlled" d.c. is applied to a servo amplifier driving a small electric motor geared down to provide the necessary torque output. In this way single channel proportional control is employed to adjust, for example, the rudder of a model boat to the correct angle for the model to move in a true circle.

This is more than just a simple refinement. Radio controlled aircraft models are structurally different, in particular the dihedral, from the free flight types, the proportional class being capable of greater ease of operation to the extent that an inexperienced modeller can be his own test pilot rather than have the club expert fly it first.

FREQUENCY BANDS

Multiple or simultaneous channels with proportional control on some, have become practicable to the extent that several models are used at the same meeting necessitating the use of superhet receivers and different band frequencies in order to prevent interaction. Each transmitter and receiver combination has a pair of matched crystals on one of the frequency bands shown in Table 1 with an appropriately coloured pennant fitted to the transmitter antenna.

An enthusiast can have several sets of crystals enabling him to take part on any vacant band or spot frequency and his transmitter is now fully transistorized making a compact hand held unit —usually fitted with joystick type controls. The highest tone frequency in common use is approximately 6 kHz and the band width occupied by a transmitter modulated by this tone is 12kHz or nearly half the separation between adjacent secondary channels, e.g. red to red/orange (Table 1) of 25 kHz. This is adequate for all practical purposes but if a higher tone frequency is used or the matched crystals are not exactly on the band frequency then interaction is possible to an adjacent secondary channel.

The single stick five function proportional "Series Four" system manufactured by Flight Link Controls Ltd.

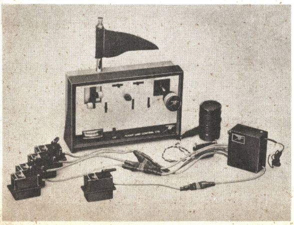


Table 1. Frequency Bands

Band Colour		Frequency
Principal	Secondary	MHz
	Black	26·970
Brown		26·995
	Brown/Red	27·020
Red		27·045
	Red/Orange	27·070
Orange		27·095
	Orange/Yellow	27·120
Yellow		27·145
	Yellow/Green	27·170
Green		27·195
	Green/Blue	27·220
Blue		27·245
	White	27·270

The band frequency on which radio control modellers operate. The matched crystals of the receiver and transmitter being colour coded and a pennant of the same colour used on the transmitter antenna.

Highly reliable commercial proportional equipment is available both ready for use and in kit form at prices from £40 to £350 dependent upon the facilities offered. The superhet receivers, often of foreign make, are produced at a figure the amateur can hardly improve on, component for component, and a saving of the labour content can only be made if a number of units are produced, as for a club, since much time must be spent in layout design alone. Similarly, the servo units incorporating a miniature motor, plastic gears etc., in a very compact and reliable form are difficult to copy.

The amateur constructor has a free field with respect to the transmitter, filter units etc., and it is common practice for a mixture of commercial and "home brew" equipment to be used, the system being basically designed for five or six channels but only one or two channels being used until the cost of a further servo unit kit is saved.

DIGITAL CONTROL

The complications of multiple filter units and the advent of more specialized semiconductors such as the thyristor, paved the way for digital control; instead of varying the modulating tone frequency of one channel to effect a control, the

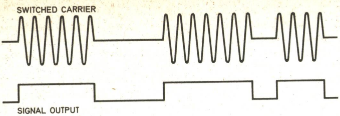


Fig. 2. The basis of the modern digital control system. The carrier wave is switched and transmitted in variable length bursts.

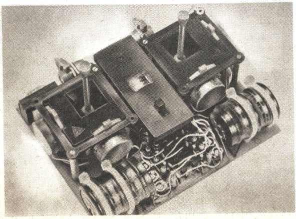
tone frequency is constant but is sent in variable length bursts (Fig. 2). The length of the burst or pulse being measured and converted to a d.c. output.

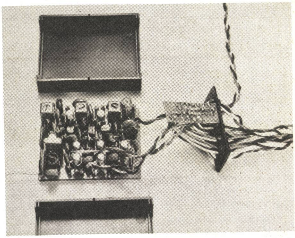
The attraction of the system is its basic simplicity and the avoidance of the difficulty of winding and accurately setting up filter coils. The disadvantage, is the necessity for synchronizing and sequence circuitry to ensure that the control on the transmitter always operates the corresponding model function. Present day technique is coupled with the availablity of cheap integrated circuits.

The number of channels that can be used with modern integrated circuit techniques is limited by fundamentals rather than cost: the rate at which a control output can be changed is proportional to the rate of measurement and hence to the number of pulses per second. If a slow rate of control is satisfactory about 12 channels may be used but if a faster rate of control is desired fewer channels must be used—6 is normal or the mean pulse length is reduced which means that the bandwidth of the system is increased to the limit of the commercial receiver. The immediate future is likely to provide more complex integrated circuits at reasonable prices.

Two transmitter frequency ranges are available 26·96—27·28 MHz and 458·5—459·5 MHz; the higher frequency range being long regarded as the domain of radio enthusiasts but is now a practical proposition with modern transistors: the future therefore may bring both frequency ranges into general use, the h.f. one being for the enthusiast with all proportional 10 channel equipment.

The Quantum Six uncased transmitter available in kit form from Remcon Electronics.





An exploded view of the Quantum Six receiver.

LICENCE

In order to operate a radio control transmitter a licence must be obtained from the Ministry of Posts and Telecommunications. This costs only £1·50 for a five year period and is well worth it considering that in the absence of a licence the authorities can fine and also confiscate all the equipment.

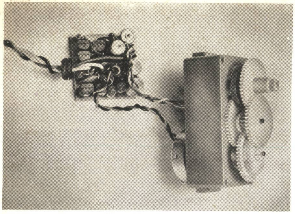
A form should be obtained from the Ministry of Posts and Telecommunications, Radio Regulatory Division (Amateur and Special Licencing Branch), Waterloo Bridge House, Waterloo Road, S.E.1.

In completing the form note that the equipment is licensed for an area defined by a 5 mile radius from a specified point; this can be varied by notifying the Post Office Telephone Manager for the Telephone Area of the alternative site: several sites may be in regular use simply by making standing notifications.

The regulations specify a "satisfactory method of frequency stabilization . . . measurement. . . ."; in practical terms this means that the oscillator should be crystal controlled using a frequency marked miniature 3rd overtone crystal with matching tuning networks for 26·29—27·28 MHz. The emissions allowed are class A1, A2, F1 and F2, the meaning being:—

A1 Telegraphy by on-off keying: the r.f. carrier not being modulated but just interrupted.

A2 Telegraphy by on-off keying of either the modulating audio frequencies or the modulated carrier.



Components incorporated in a typical modern servo unit. *(Remcon Electronics)*

F1 Telegraphy by (unmodulated) frequency shift keying.

F2 Telegraphy by on-off keying of either the modulation or carrier frequency shift.

The power output is restricted to 1·5 watt (26·96—27·28 MHz) maximum (mean) effective radiated power; if an antenna other than the usual loaded Marconi type is used this figure must be derated by the gain of the antenna. If 100 per cent amplitude modulation is applied to a carrier the peak power is increased four times, the r.m.s. or mean power being $\sqrt{2}$ x 4 times the unmodulated carrier.

In the case of a valve type transmitter the unmodulated r.f. power can be taken as the d.c. anode volts multiplied by the d.c. anode current. In transistor transmitters, unless specialised transistors and circuitry are employed, the maximum obtainable unmodulated power is of the order of 0·5 watt for 12—15V supplies. In general a simple output stage is capable of approximately 250 mW r.f.

RANGE

The maximum range of a transmitter can only be properly quoted in relation to a given receiver of adequate sensitivity, and this presupposes that all factors, including the disposition of the antennas, are favourable.

For indoor (very short range) applications a transmitter with an output stage capable of 200 mW feeding a simple 30 inch rod antenna is adequate. If the same transmitter and antenna is used to control an aircraft it will be found that the range varies markedly with the disposition of the receiver antenna, and other factors and may be as low as 200 yards. In order to provide an adequate range with a factor of safety to provide for contingencies such as changing battery volts, detuning due to vibration, etc., the power output should be increased and a matched and efficient, loaded antenna used.

The super-regenerative receiver is easily made and has high sensitivity, its great disadvantage being that in regions of high signal strength it can be "pulled " easily, responding to any signal close in frequency to the one it was tuned to. In practice this means that a more complicated and expensive superhet receiver should be used whenever two models are operated in close proximity, e.g. boats on a lake.

The novice could well be advised to start by controlling a model boat where there is little weight restriction and control failures are not disastrous. Simple equipment is all that is necessary with one or two channels only, for controlling the rudder and engine speed.

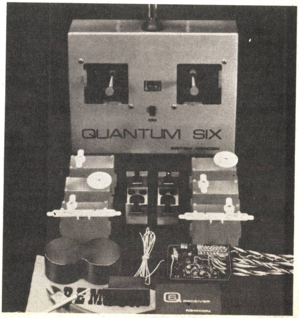
If starting completely from scratch a digital system could well be considered since the system could be extended at a later date. It may be thought that a digital system even with only two channels and servoamps is basically too expensive, in which case a simple single channel system could be considered.

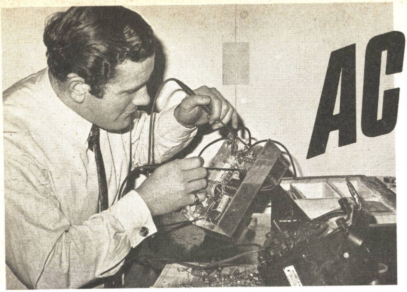
SUPPLIES

Initially dry batteries may be used for a venture into model control but for serious modelling and with regard to the safety factor and economics Deacs or rechargeable cells must be used. These have the advantages of lower internal resistance, a good power to weight ratio and, after the initial outlay, insignificant running cost.

Deacs may be charged with care from a "trickle charger" but it is usual to construct a special light duty unit for the purpose which makes use of the Deac characteristic to prevent over-charging. ▣

The complete six channel proportional system from Remcon Electronics Ltd. The system is available in kit form.





ACTION!

Another look at an electronics evening class.

TEN weekly lectures in basic electronics was the course started by development engineer John Matthews at Hilderstone Adult Education Centre at Broadstairs, Kent, in September 1971. On completion of this first course entitled "Transistors and Semiconductor Devices" many of the students suggested a follow-up course and, because of this, further courses are planned for this year.

The course held was one of theory and practice and John explained fully the function of most common components from the diode up to an integrated circuit. Visits to local electronics firms were also arranged whereby the students could get some insight into "industrial" electronics; these helped to stimulate interest and provide background knowledge.

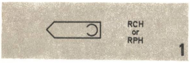
For practical projects some of the EVERYDAY ELECTRONICS circuits have been used together with other designs. The students who took the first course come from jobs as varied as the projects they have constructed—from electricians to hovercraft pilots, and from chemists to draughtsmen.

Many of these students will be taking further courses, and any reader interested in taking part should write to John Matthews, care of Hilderstone House, Broadstairs, Kent.

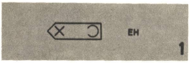
Some of the students who took part in the "Transistors and Semiconductor Devices" course being given constructional advice and instruction from John Matthews (standing). The students are, from left to right back row first: M. Fenney, I. Stockdale, V. Lane, R. Collins, M. Kennedy, and J. Wood.

guide to circuit

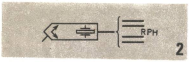
Transducers



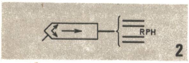
Head for magnetic tape or drum (monaural record or replay)



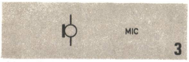
Erase head for magnetic tape or drum



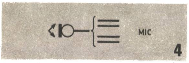
Stylus operated piezo - electric stereo pick-up for reproducing



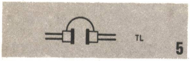
Stylus operated stereo pick-up for reproducing



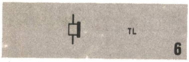
Microphone (mono)



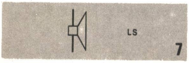
Microphone (stereo)



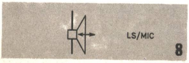
Headphone, stereo (one wire from each side for mono)



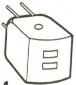
Earphone, mono only



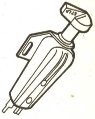
Loudspeaker



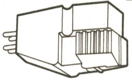
Loudspeaker, microphone

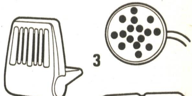


1

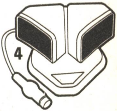


2





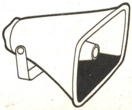
3



4

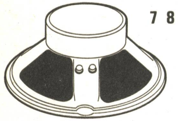
5

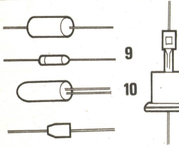
6

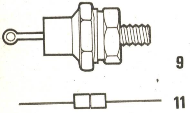


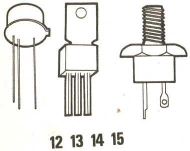
7

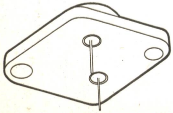
symbols . . . part 5



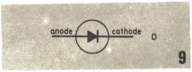




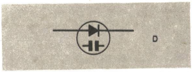




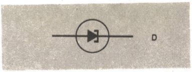
Semiconductors



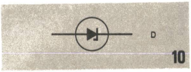
Semiconductor *pn* diode (Note: the cathode end of most diodes is usually marked with a plus sign or a red spot or band)



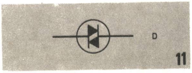
Diode used as a capacitive device, for example varactor



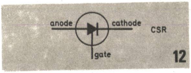
Tunnel diode



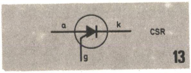
Unidirectional breakdown diode, voltage reference diode, for example Zener



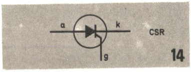
Bidirectional diode, diac



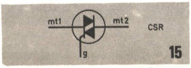
Controlled semiconductor rectifier, thyristor general symbol



Reverse blocking triode thyristor, *n* gate



Reverse blocking triode thyristor, *p* gate



Bidirectional triode thyristor with two main terminals and trigger gate, triac

The Beta guitar incorporating two electronics effects.

ELECTRONIC GUITAR

by Brian W. Terrell B.Sc.

see FREE BLUEPRINT WITH THIS MONTH'S ISSUE

WITHOUT doubt, one of the most popular instruments of recent years and still today, is the electric guitar. Its popularity is easily seen by looking at and listening to the records in one of the national record sales charts, to find that almost every record features a guitar, mostly electric, in one form or another in conjunction with an accessory such as fuzz, tremolo, vibrato, waa-waa, treble boost etc., which are either built into the amplifier or self-contained in a box situated on the floor and foot-operated.

WHY DO-IT-YOURSELF?

Guitars and effects boxes are so readily available in so many shapes, sizes and forms that one may ask "why build your own?"

Perhaps the short answer to this is cost. Guitars to begin with can be very costly, prices ranging up to £300 or more for ones commercially available and even more in some cases for "custom built jobs".

An average price to pay for a reasonable instrument is about £40.

Effects boxes seem to cost a lot of money for what they actually consist of—electronically speaking—but are probably worth the enjoyment and satisfaction they give to their owners (and

Approximate cost of materials £7·50

fans). Typical prices for the common effects boxes vary between £7 and £15.

Other factors, leaving cost aside, stem from the fact that musicians like to be individualists, and own equipment (providing its good) that others don't. This is what you can do by building your own guitar, and add your personal "touches" such as pick-ups and positioning, controls and location, colour and other refinements.

ELECTRONIC

The guitar to be described here, and known as Beta, is a guitar with a difference. It differs from most other solid electric guitars in so far that it has electronics effects built into its body. These effects can be brought into operation by the flick of a switch whilst playing. Both units—fuzz and treble boost—are powered by a single PP3 battery located in the control recess—but this will be fully described later.

It is therefore quite in order to call the Beta an electronic guitar—it is different already.

WOOD

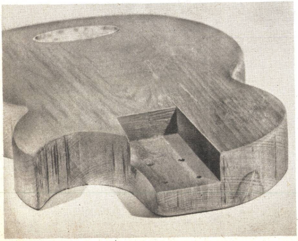
The wood content of the guitar, as can be seen in Figs. 1 and 2 on the blueprint enclosed in this issue, is essentially three pieces of wood, the body, the neck and head (made in one) and the fretboard. The choice of material is important but not critical.

In all cases the wood should be of the hard variety such as oak, teak, beech, etc., the important properties of these woods being that they have a close grain, are strong, do not distort or split easily under strain and can be engineered more accurately than softer woods.

Bearing in mind the cost and availability of these materials, beech was chosen for use in the prototype for the body, and neck and head combination, and teak as that for the fretboard since the latter is slightly softer in some respects as is required for fixing the fret wire in position.

For the body you will require a piece of beech about 13in. by 17in. by 2in. thick. For the neck and head combination a piece of beech 30in. by 3in. by 2in. with grain along the length, and a piece of teak board approx. 20in. by $2\frac{1}{2}$in. by $\frac{1}{4}$in. for the fretboard.

The guitar body in early stage of construction showing stem recess cut out.



BODY OUTLINE

Begin construction with the body of the guitar. Transfer the outline shape of the guitar from the blueprint, Fig. 1, to the piece of beech wood (do not cut the blueprint).

This can be done in two ways by (i) tracing the outline and sticking the tracing on the face of the wood, or (ii) place a piece of carbon paper on the wood face, place the blueprint on top and follow the outline on the blueprint to give a direct transfer onto the wood. These methods can also be used with all the other full-size drawings of the guitar parts.

Whichever method is used for the body, ensure that the centre line is clearly scribed. The centre line is marked in Fig. 1.

When the prototype was being constructed a very useful tool was a G-clamp. It is recommended that one of these be used to make the work easier.

CUT-OUTS

With the outline and centre line clearly marked, clamp the body wood down tightly on a bench top, top side up, and mark out the positions of the stem recess as detailed in Fig. 1. Cut out this recess and drill the six holes in this recess labelled "C".

Mark out the positions of the two pick-up recesses, the tailplate recess and cut out as detailed, using mallet and chisel.

The two switch slots on the face of the body should now be marked and made. These are best done by drilling at the ends of the slots and chiselling out the remainder. Note that the slot nearest the tailplate position is to be right through the body whilst the other is only halfway through from the front face.

Now mark and cut out the channel to accommodate the cables from the switches and pick-ups. This channel terminates near the rear pick-up in a $\frac{3}{8}$in. diameter hole drilled right through the body.

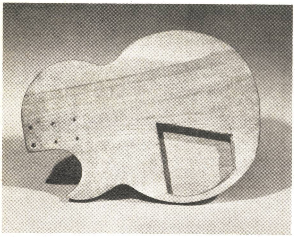
In the channel section linking the upper switch recess to the upper pick-up recess, lay in a length of $\frac{1}{4}$in. plastic tubing such as that used for petrol pipe. Fill in around this tube with a filler such as plastic wood. This tube is to allow the cable for the effects switches to reach the control section.

When all these cut-outs have been made, the body can then be cut to shape, slightly oversize to allow for cleaning up.

With the prototype, the body was cut using ordinary hand saws, chisels and files but took considerable time and effort—but this was justified by the end result. If you can get the timber yard or shop where you purchased the wood to cut it for you on their bandsaw, this is recommended.

Whether hand or machine cut, the edges will be rough and will have to be shaved down and smoothed. It is recommended that the smoothing is left till later. Shaving can be done with plane, Surform, rasp or rough file. You will probably end up using all of these tools for different parts of the body.

There are two further cut-outs to make, one on the edge and one to the rear face of the body for the jack socket and control section respectively. These should now be marked, cut and drilled as indicated in Fig. 1.



The rear face of the body showing the cut out to accommodate the electronics and controls.

The control recess, which is $1\frac{1}{2}$in. deep into the rear face of the body is to be made first and is easily done with chisel and mallet, but care should be taken where the recess comes close to the body edge. The shape and position of this recess is shown dotted in Fig. 1—do not forget the $\frac{1}{8}$in. deep lip for holding on the backplate.

The $\frac{7}{8}$in. diameter hole for the jack socket should be drilled from the edge through to the control section recess as detailed in Fig. 1.

Mark the positions of the four 'D' holes and drill through to the control section. Leave the body to one side for the moment.

NECK AND HEAD

Referring to Figs. 2a and 2b on the reverse side of the blueprint, the neck and head are shown in front and side view (left and right respectively). The neck and head are to be made in one. For this use the piece of beech size 30in. by 3in. by 2in.

Begin by marking out the side view of Fig. 2a along the 30in. by 2in. side of the length, aligning the face where the fretboard is to be attached and the end opposite the head with the corner of the length of wood.

Now use Fig. 2b side view (head profile) to transfer this shape to the top of the neck so it is now in one piece. You should now have the profile of the complete neck/head assembly.

Saw the slope on the front face of the head and smooth with plane and sandpaper.

Draw a line right down the centre of the 30in. by 3in. face, including the sloping head. Next mark out the front view of the neck and head about this centre line making sure that both views line up on the wood length.

The next job is to cut out the neck/head—leave the nut slot for one moment. Once again, if a bandsaw is available it is recommended that this be used, otherwise handsaws, chisels and rasps will be needed.

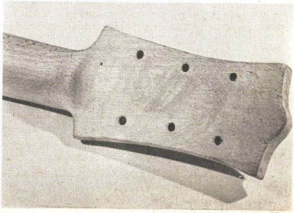
The method of cutting is left to the constructor to suit his own skills. Whichever method is used cut slightly oversize, it can be planed and filed to final shape later.

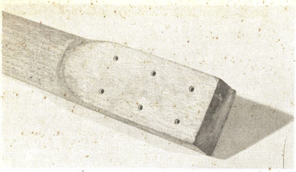
JOINT

Plane or chisel the end of the neck that is to fit into the guitar body to give a tight fit—but not too tight. Ensure that the centre line through the body lines up with that along the neck/head.

When satisfied with the joint, mark through from the back the positions of the six 'C' holes and then drill these 1in. deep into the neck with a $\frac{1}{8}$in. diameter bit. Replace the neck and secure to the body with six 2in. long No. 10 screws. Screw in fully. Now that the screw threads have been established remove the neck and commence rounding off the back side of the neck as indicated in the cross-section of Fig. 2b.

Photograph of the sloping head of the guitar with holes drilled to position machine heads.





Photograph of the neck section that fits into the guitar body.

This is best done with a heavy duty half-round file or rasp.

The regions where the head joins the neck, and the neck joins the body, should be shaped as indicated in Figs. 2a and 2b, and the photographs of the neck/head assembly. Shave the neck and head right down to the markings. The hard work is now over.

FRETBOARD

The fretboard is made from a piece of teak although mahogany would be just as good. Cut the board to the correct length but leave oversize as far as the width is concerned.

Place the blueprint, Fig. 2a (left hand side) over the teak board and hold flat in position with drawing pins at each of the "E" and "F" holes. Using a large pin, prick through the blueprint along the centre line and either side of it at the 19 fret positions. The line to prick through for the fret saw line positions is the thin dotted one between the two close thick ones which represent the frets themselves.

Remove the drawing pins and blueprint from the fretboard and using the pin pricks draw in the centre line and the fret position lines. The eight holes at "E and F" will have been marked with drawing pins. Drill these holes as detailed.

With the neck screwed into the body, place the fretboard on the neck, line up the centre lines and secure in this position with two small round-headed screws through two of the drilled holes in the fretboard. These screw holes are essential for locating the fretboard in the correct position when glueing in place later. Shape the fretboard to that of the neck.

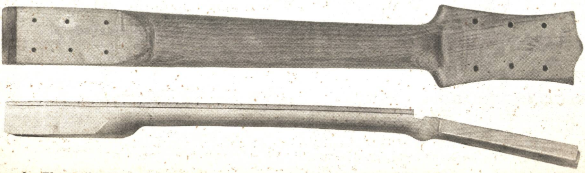
Now, using a fine sawblade, cut the slots along the fret position lines (19). Make these slots about $\frac{1}{16}$in. deep. Remove the fretboard from the neck and lay on a flat surface.

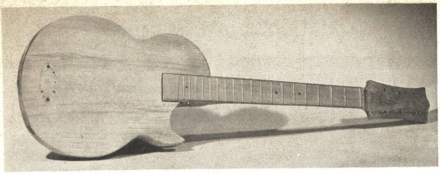
Materials ....

SEE
SHOP TALK

Wood
Beech 18 x 13 x 2in. (body)
Beech 30 x 2 x 3in (neck/head)
Teak 20 x $2\frac{1}{2}$ x $\frac{1}{4}$in. (fretboard)
Fretwire
$4\frac{1}{2}$ft. standard
Perspex
12 x 12 x $\frac{1}{8}$in. (scratch plate and switch covers)
Aluminium
$3\frac{1}{2}$ x 2 x $\frac{1}{4}$in. (tailplate)
$\frac{1}{2}$in. dia. tube $3\frac{1}{8}$in. long
$1\frac{5}{8}$ x 1 x $\frac{1}{16}$in. (jack socket cover)
Steel plate
$4\frac{1}{2}$ x $2\frac{1}{4}$ x $\frac{1}{16}$ in. (stem support plate)
Plastic tubing
2 x $\frac{1}{4}$in. internal diameter
Plastic rod
$1\frac{1}{2}$ x $\frac{1}{4}$in. diameter
$1\frac{1}{2}$ x $\frac{3}{16}$in. diameter (No. 5 & 7 crotchet needles) (finger position markers)
Screws and Bolts
2in. long countersunk (6 off)
1in. long countersunk (4 off)
$\frac{1}{2}$in. long round headed (2 off)
$\frac{1}{4}$-$\frac{3}{8}$in. long, thin chromium plated for fitment attachment (24 off) 1in. long, copper or brass plated (4 off); 1in. long 4BA (2 off)
Miscellaneous
Adjustable bridge; strap; strap fasteners (2 off); individual machine heads (6 off); set of steel strings (6); adhesive, filler and sandpaper.

The complete neck/head assembly with completed fretboard glued in position. Shows the "shaping" at the neck/head and neck/stem regions.





The Beta nearing completion of the "raw" state.

Cut the fretwire in lengths to suit each fret position and push the wire in position from above. It must be a tight fit, and it should be necessary to have to tap them in with a small hammer or press them in with the aid of a metal vice. They must be pressed in as far as possible.

When all the frets are in position and fully sunk in, apply some adhesive to the fretboard (rearside), Evo Stik is ideal, and with the help of the two screw threads in the neck, locate in the correct position and allow to set with the screws tightened.

FRET ALIGNMENT

When set firm remove the locating screws and file the ends of the fret wire flush with the edge of the fretboard/neck, and then chamfer each end of the fretwire (including the fretboard) so that you cannot feel the presence of the fret as you run your finger down the edge of the fretboard.

When you are satisfied with all the frets, file the tops off them so that there is about $\frac{1}{16}$ to $\frac{1}{32}$in. flat. Finish off with coarse and then fine emery cloth so that the frets are free from file marks.

Place a flat edge along the top of the frets, spanning all of them, and determine if any are high; if there are, file to correct. Further filing may be necessary after fitting the strings.

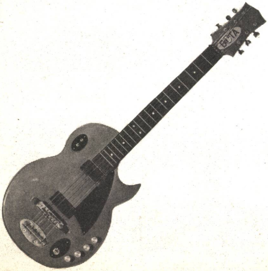
The "E" and "F" holes at various positions along the fretboard are for finger positioning. In the prototype these were filled with short lengths of white plastic knitting needle, and glued in.

Now cut out the slot to accommodate the nut (Fig. 2a).

Examine the machine heads you have obtained and see if the locating holes shown in the head, Fig. 2b, are satisfactory. If so, drill these positions to suit diameter of machine head spindle, if not, re-position and drill to suit. Secure the machine heads in position.

With reference to Fig. 4 make the nut. This should be made from a plastic material such as Perspex. The width of each slot should be made to suit the diameter of the strings to be used. The depth of the slots should be cut so that the strings, when fittted, will just clear the first fret when taut. This may have to be done by trial and error later so this fitment should not be glued in position at the moment.

Next month: details of guitar fitments and pick-ups.



PLEASE TAKE NOTE

Cassette Tape Power Supplies—**page 641**
Fig. 3. (October issue). The wrong circuit symbol was shown for the Zener diode D 1. See *Guide To Circuit Symbols* in this issue.

Reactomatic—**page 651. In the text reference is made to VR4, this should be VR1.**

BASIC Electricity

1 The Battery

By Maureen Birch

How many appliances have you at home at this moment which need batteries to operate them—torch, radio, shaver, model car etc? You must sometimes have asked yourself how these batteries work and how a current is produced by them.

DRY CELL

If you can unearth a small dud 1·5 volt battery — or **dry cell** as it is called — carefully dissect the outer steel case, cardboard sleeve and zinc container. Having done this you should be able to identify all the parts shown in Fig. 1.1a.

Notice that the inner container is grey zinc metal and the metal cap terminal at the top is connected to a carbon rod which runs the length of the inside. Around this rod is a moist, black mixture of manganese dioxide powder and ammonium chloride crystals. Although this is called a dry cell the chemicals inside it must be damp for it to work properly.

You will know from experience that dry cells come in all shapes and sizes. It is obvious that a large cell must contain more chemicals and therefore it lasts longer, but increasing the size will not increase its voltage. The output from a single dry cell is 1·5 volts and if more is needed many cells are joined together. Thus the 9 volt battery of the type used in transistor radios etc. is six layer type cells stacked inside one case and connected in series so that the carbon of one is in contact with the zinc plate of another Fig. 1.1b.

CHEMICAL REACTION

Now we come to the crux of the matter—how does the cell produce an electric current? The battery contains a supply of chemicals which react together to create a cloud of small particles

Fig. 1.1a. Shows the internal construction and composition of a "dry" cell.

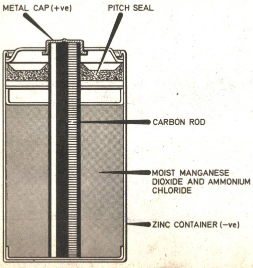
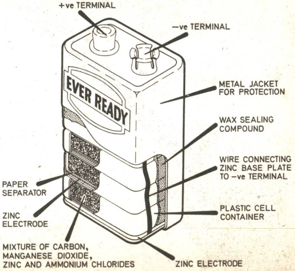


Fig. 1.1b. Stacking of six layered cells to make a 9V battery.


+ve TERMINAL
−ve TERMINAL
EVER READY
METAL JACKET FOR PROTECTION
WAX SEALING COMPOUND
WIRE CONNECTING ZINC BASE PLATE TO −ve TERMINAL
PAPER SEPARATOR
ZINC ELECTRODE
PLASTIC CELL CONTAINER
MIXTURE OF CARBON, MANGANESE DIOXIDE, ZINC AND AMMONIUM CHLORIDES
ZINC ELECTRODE

called electrons around the zinc case and at the same time the carbon rod has a shortage of electrons. Electrons are small negatively charged particles. Therefore we say that the zinc case is the negative terminal and conversely the carbon rod is positive.

When the cell is connected to a bulb the electrons flow away from the zinc case through the bulb and back to the carbon rod in an attempt to even things up. This is a continuous process because the zinc case immediately provides more electrons to replace those that have just left. This is a very simple explanation but it leads us to one important and basic fact—that an electric current is a flow of tiny negatively charged particles. Later, when we are talking about the magnitude of current we shall use units called **amperes** to describe it.

When the chemical energy which produces the electrical energy is used up, the battery is said to be flat and the current fails. It is possible to "refill" a used cell but this is not easy and is not worth the trouble. The zinc case is used up in the chemical reaction and in modern cells the thickness of this case is not very great—thus ultimately it may become completely eroded away—this leads to the cell leaking.

ELECTRONS

Before we go any further we must consider in more detail the electrons which we have only mentioned briefly so far. All matter surrounding us whether it is solid, liquid, or gas is made up of atoms and an electron is a small part of an atom. Most atoms contain many electrons travelling at great speeds in orbits around the centre, or nucleus as it is called—rather like planets travelling around the Sun. Each electron has a negative charge and the nucleus contains enough positively charged particles—called protons—to balance the electron charges; thus the atom as a whole is neutral.

If we now return to our dry cell producing a current and running a light bulb, it is clear that as the electrons leave the zinc plate on their journey to the bulb and then back to the carbon rod they must travel in a substance which will allow the flow to continue easily. Such substances are called conductors and gold, silver, and copper are particularly good. Gold and silver are obviously too expensive to use for wiring and so copper is extensively used.

Insulators are substances which do not conduct electricity and these are used to cover conducting wires—rubber and plastics are examples of these.

Now what, you may be asking, is the difference between copper and rubber that makes one a conductor and the other an insulator?

CONDUCTORS AND INSULATORS

To understand this problem we must think about the atoms which make up these substances. Some of the electrons in a conductor, such as copper, are very loosely held in their orbits and can be made to drift along if they are pushed by the electrons coming from a battery. These loosely bound electrons will be pushed from atom to atom until they find one with a shortage, or an electron may secure a place in an atom by pushing out another electron which will in turn move on to find itself a home. It is important to understand that the electrons which set out from one end are not the same ones which reach the other.

Insulators, on the other hand, do not have loosely coupled electrons, and thus are not able to carry a current

One confusing fact about electricity is that, by convention, current is said to flow from the positive to the negative terminal of the battery although, as we have seen, it is a flow of electrons in the opposite direction

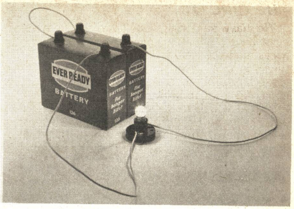
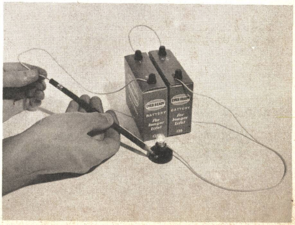


Fig. 1.2. Simple experiment to illustrate the principle of "current flow" in a "circuit".

Fig. 1.3. Introducing a resistance into the circuit of Fig. 1.2, by means of the graphite through a lead pencil, dims the glow from the bulb.



THE CIRCUIT

We have said that for a current to flow, we must have a source of current e.g. a battery and wires made of conducting material (copper), but there is one other important condition which must be fulfilled, and this is that the current must have an unbroken path, or circuit as we call it, in which to travel. We call this unbroken path a closed circuit and in our homes most of the electrical apparatus is fitted with a switch which will open or close the circuit as required.

EXPERIMENTS

At this point you can do some simple experiments. Obtain two 4·5 volt batteries with screw terminals—this makes the attachment of wires much easier—a 6V 0·12A torch bulb, a holder for the bulb and some insulated flexible wire—one of the cores from ordinary lighting flex will do.

Connect the batteries to the bulb as shown in Fig 1. 2—they will provide us with 9 volts. Notice that the bulb glows brightly as the current is flowing in copper wire. Now introduce a lead pencil into the circuit (Fig 1. 3)—lead pencils have a core of graphite. Hold the wires at either end of the core of the pencil (not on the wood) and notice that the lamp still lights but not as brightly as before This is because graphite is not as good a conductor as copper. It is providing a certain amount of resistance to the flow of electrons

We can show this even more dramatically by substituting the element from an old 1 kilowatt electric fire for the pencil graphite, Fig. 1. 4. If you use the whole length of the element you will be introducing a lot of resistance and the bulb will glow dimly. Use less of the element wire and the bulb will glow brighter thus showing that the circuit resistance is less. Later on we shall give numerical values to resistance and we shall use units called **ohms.**

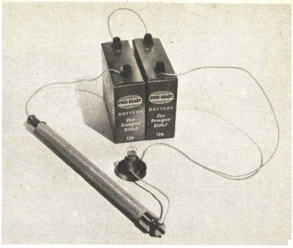


Fig. 1.4. Using an old electric fire element as a resistor.

Next month: Current flow through liquids.

Ruminations

By Sensor

Away from it all

I think that most of us feel the need to withdraw ourselves occasionally from our surroundings, mentally at least, and retire into our own private world. One can soon become oblivious to everything going on around if deeply involved in some absorbing pursuit. Electronics can be a most satisfying hobby because it embraces so many arts and sciences.

The amateur woodworker can express himself in the construction of cabinets for his electronic gear while the would be metalworker can indulge himself in the creation of chassis and cases. Those who prefer to experiment with circuits can do so with simple "breadboard" construction "just to see if it works". One may become interested in circuit design, or merely build from published designs. The hobby can be enjoyed at any level, just as one wishes.

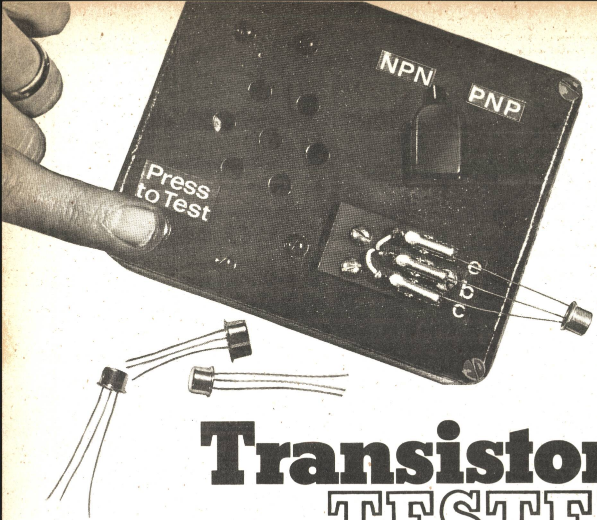
A place of one's own

As a boy, most of my electronic projects were built upon the dining room table. This meant that I was required to clear the table for each meal and therefore could not easily embark upon a large project. When I started to build my first large project I first bought a cheap card table and this became my bench. It stood in a corner of the room and work could be started or stopped just whenever I wished—a great improvement over the dining room table.

If space permits, a room of one's own for a workshop, has definite advantages; I once saw a tiny workshop created in a cupboard under the stairs. There was just room for one person and a small seat and a bench, like a shelf, but it served the purpose admirably.

When visiting a friend who had just moved into a new house I was invited conspiratorially to "follow me'. He produced a pair of stepladders and led the way to the loft space, there, around the central chimney stack, he had built a bench and storage cupboards for tools and components. "I can get away up here," he said.

From his air of secrecy, I concluded that his wife was not aware of the existence of his little sanctum! I wondered what she thought when he disappeared for long periods. Did she see that tell-tale ladder on the landing or did he pull it up behind him? Was she disturbed by strange noises from somewhere up aloft? I didn't like to ask these questions, he had shown me a glimpse of his private world and I felt that his confidence must be respected. Wouldn't you?



Transistor TESTER

A rapid tester for checking most transistors.

By P. A. Graves

A CONTINUAL problem to the experimenter is the need to test transistors to check if they are functioning. Experience shows that transistors rarely fail slowly like valves, they usually go open or short circuit on one or more junctions. This means that they can be tested with an ohm meter.

The testing technique seems to have been invented by a three handed service engineer! It requires six separate measurements to completely test the transistor, assuming you do not forget where you have got to, while holding the transistor in one hand and trying to manipulate the ohm meter probes with the other.

The alternative is to build a proper transistor tester. This is where the trouble begins again! Some types of tester seem to have so many controls that they would not be out of place on an aircraft flight deck, and others require sensitive, and expensive, meters. Operation of the simpler types requires adjusting backing off voltages, several readings from meters and a calculation afterwards.

The Transistor Tester described in this article checks transistors by operating them in a simple oscillator circuit, which gives a very good indication of their functioning.

CIRCUIT

The circuit (Fig. 1) at first sight seems a little fearsome due to the switching arrangements which are needed to cater for both *npn* and *pnp* type transistors. The circuit is basically a simple multivibrator.

Approximate cost of components £1·85 plus case

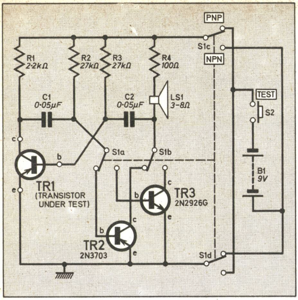


Fig. 1. Complete circuit diagram of the Transistor Tester.

The multivibrator acts as an "electronic see-saw." TR1 (the transistor being tested) and TR2 (or TR3) switching on and off alternately, at a frequency determined by C1, C2, R2 and R3; these are chosen to provide oscillation in the audible frequency range. Pulsating current flowing in TR2 (or TR3) collector, as the transistor switches on and off, causes an audible tone to be heard in the loudspeaker LS1. Resistor R4 limits the current flowing in TR2 or TR3 but allows enough to provide a reasonable output from LS1.

Provision for checking *pnp* and *npn* transistors is made by switching in a similar type in the TR2 position (TR3) and switching the battery polarity to suit, this is done by S1.

Only if TR1 is working will the tester oscillate giving an audible tone when S2 is pushed.

COMPONENTS

None of the components are critical, almost any general purpose transistors that can pass a collector current of about 100mA will be suitable for TR2 and TR3. The loudspeaker can be any small 3 to 15 ohm type. Switch S1 is a four pole two way rotary type wired up as will be shown later.

CONSTRUCTION

The prototype unit was constructed in a small diecast case that provides a very tough and business like finished unit. Commence construction by drilling the removable panel as shown in Fig. 2.; all the components will be mounted on this panel.

Next affix the loudspeaker, S1, S2 and the clip to hold B1. Having done this wire up the tag board as shown in Fig. 3, soldering in the two transistors last, using a heat shunt on each lead as it is soldered.

Before wiring up the unit the three small crocodile clips must be mounted on a piece of paxolin by their connecting screws and then mounted on the panel as shown in Fig. 4, using another piece of paxolin to insulate them from the case.

Components....

SEE
SHOP TALK

Resistors

R1	2·2kΩ
R2	27kΩ
R3	27kΩ
R4	100Ω

All ± 10% ¼W carbon

Capacitors

C1	0·05μF
C2	0·05μF

Transistors

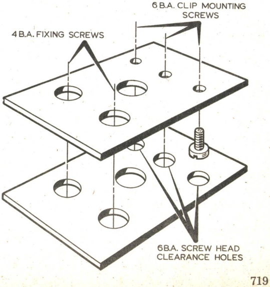
TR1	Transistor under test
TR2	2N3703 silicon *pnp*
TR3	2N2926 (G) silicon *npn*

Miscellaneous

LS1	3 to 15Ω miniature loudspeaker (approx. 2 in. diameter)
S1	4-pole 2-way wafer switch
S2	Single-pole push to make push button.
B1	9V PP3 battery

Three miniature crocodile clips, 11 way tag strip, Terry clip to hold B1, small pieces of paxolin to mount connection clips, die cast box, approx. 4¾ x 3¾ x 2¼ in., pointer knob, 4BA fixings, connecting wire.

Fig. 4. The two pieces of Paxolin used to mount the clips for TR1. Each piece measures 1in x ¾in.



Transistor TESTER

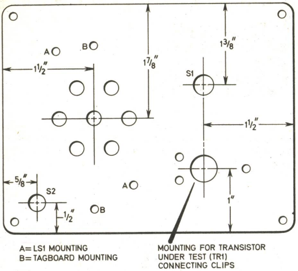
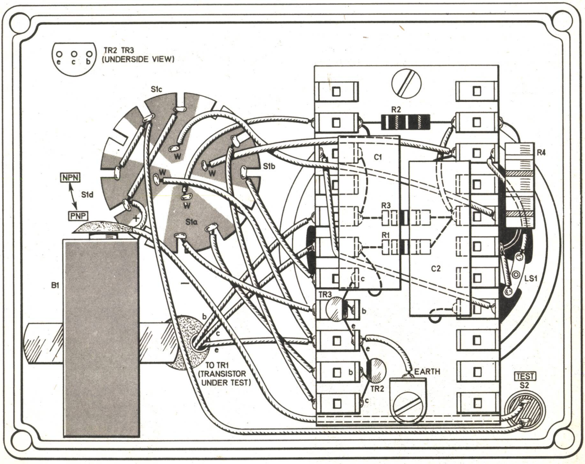
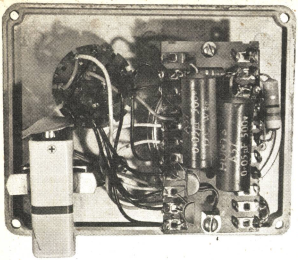


Fig. 2. Front panel drilling details dimensions of some of the holes will depend on the components used.

Fig. 3. Internal view of the complete unit showing component layout and wiring.





Internal view of the prototype.

Finally, mount the circuit board, on two long bolts, over the speaker and connect up the unit.

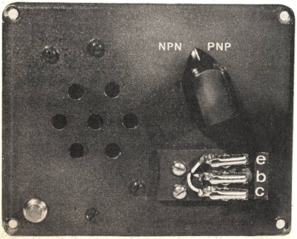
TESTING

After checking all the connections, connect the battery observing polarity, insert a good transistor in the clips—again observing lead connections—select *pnp* or *npn* on S1 and press S2. If all is well a bleep will be heard signifying that the oscillator is functioning. Now test the other position of S1 by inserting a different good transistor in the clips (i.e. if *pnp* was used first use an *npn* type or vice versa).

Remember that this unit provides a quick check on most types of transistor—it cannot be used for f.e.t's or unijunctions and it will not test all the parameters of the device.

To complete the unit designate the panel as shown in the photographs and either paint it or at least coat the lettering with clear varnish to protect it. ▣

Front panel markings of the completed unit.

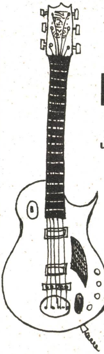


NEXT MONTH

Demo Circuits

Don't discard your Demo Deck—a new educational series using it starts next month. Operation of various basic circuits will be described.

radio control transmitter



A single channel transmitter will be described next month and a receiver the following month.

BETA

The pick-ups and fittings used in the Beta guitar.

All in the

December

On sale Friday, November 17

THEY MADE THEIR MARK

No 6 Faraday

(Part 2)

By J. E. Gregory

Photograph: Science Museum, London.

Last month we left Michael Faraday demonstrating the first dynamo to the Royal Society, but he did not stop to put his discoveries to practical use. When he was made Director of the Royal Institute laboratories he said "I must continue to discover new facts".

ELECTROLYSIS

His earlier European journeys with Sir Humphrey Davy had attracted him to the work of Ampère and Volta.

His very first experiment recorded as early as 1812 had been to make a voltaic pile with seven halfpennies, seven discs of sheet zinc and six pieces of paper moistened with salt water. With this pile he decomposed magnesium sulphate. This was the start of his work on electrolysis and his electro-chemical experiments, which later led him to introduce the apt terms "electrolyte", "electrode", "anode" and "cathode", which are still in use today.

Faraday also carried out numerous electrostatic experiments, and he found that the electric charge induced between one conductor and another depended on the material or "dielectric" between them. In recognition of this discovery, the name Farad was given to the unit of electrical capacitance (see Table 1 last month).

Overwork was starting to take its toll and in 1841 Faraday was ordered to take a complete rest in Switzerland. Then in August 1845 he started to examine the relationship between light and electricity. For this he conducted a magnificent experiment with a horseshoe magnet and a Nicol crystal prism. He passed a beam of polarized light through the crystal along the direction of the magnetic field. He found that the plane of polarization of the light was rotated as it passed through the crystal.

In the same year he also discovered that all substances have magnetic properties to some degree. Some bodies tend to move in a magnetic field towards the stronger parts of the field; this effect he called "paramagnetism". Other bodies tend to move into the weak parts of the field; this he called diamagnetism.

His three volumes "Experimental Researches in Electricity" covering his discoveries from 1831-1855 are accepted as classics and have been described as "One of the richest treasuries of knowledge which has ever been presented to the world by a single intellect".

HONOURS

By now Faraday was a world famous figure and honours were showered upon him, but he declined a knighthood and the Presidency of the Royal Society for fear they would interfere with his experiments, and lecturing. His lectures to children at Christmas had become almost a national institution, two regular patrons being the Prince Consort and the young Prince of Wales. Commemorative Faraday lectures are still given at Christmas time today. They were introduced by the Institute of Electrical Engineers in 1924 with the object of informing the general public about recent advances in the applications of electricity.

Faraday never relied on his memory, which was always bad, and wrote everything down, ideas, lecture notes and experiments. His diaries were later edited and published in 1932 in seven volumes.

Faraday's experimental work ended in 1855 when he retired. He shunned publicity preferring to live a simple Christian life. Since childhood he had belonged to a small religious sect, the Sandemanians and always found time to attend their meetings. At the age of thirty he had made a public confession of his faith.

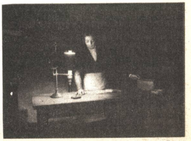
Faraday delivered with some difficulty what was to be his last lecture at the Royal Institution in June 1862. He realised he was gradually becoming paralysed.

In 1858 Queen Victoria had placed at his disposal a Grace and Favour apartment in the precincts of Hampton Court and it was here that he died on August 25th, 1867, sitting quietly in his chair.

A grateful nation wanted to honour him with a national funeral at Westminster Abbey, but in accordance with his own wishes he was buried in perfect silence at Highgate Cemetery, London.

Diorama showing Faraday in his laboratory.

Photograph: Science Museum, London.



JUST ARRIVED! THIS YEAR'S NEW RUSSIAN MIRACLE! *"COMPUTERISED"?

BRAND NEW, 'SPACE AGE' model – SO FAR AHEAD OF ITS TIME IT WILL STILL BE MAKING MANY LOOK OUT OF DATE IN 1984!

THE FABULOUS ASTRAD 17 PORTABLE RADIO & COMMUNICATIONS RECEIVER

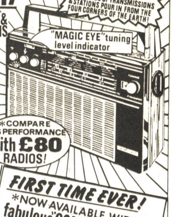
This OFFER ONLY FROM US!

WORLD WIDE RECEPTION THOUSANDS OF TRANSMISSIONS & STATIONS POUR IN FROM THE FOUR CORNERS OF THE EARTH!

28 TRANSISTORS AND DIODES! WAVEBANDS: STANDARD LONG and MEDIUM Plus 5 SHORT WAVEBANDS Plus ULTRA SHORT WAVES (V.H.F. AM. FM. MW. LW. USW.)

BATTERY MODEL £20·75 BOX POST ETC. 50p

MAINS/BATTERY ELIMINATOR £1·48 extra


"MAGIC EYE" tuning level indicator
*COMPARE ITS PERFORMANCE with £80 RADIOS!

FIRST TIME EVER! *NOW AVAILABLE WITH fabulous "COMPUTERISED" WORLD TUNING GUIDE! NO MORE GUESSWORK – INSTANT DATA at your fingertips – enables you to TUNE IN A FLASH to transmissions the world over!

ALMOST UNBELIEVABLE! Think of the year 1984 and what might be produced then—now get the fantastic ASTRAD 17 and SEE for yourself that the incredible Russians have done it all NOW! It's the radio perfectionist's dream come true! THIS ONE SUPERSEDES ALL EARLIER MODELS! It will probably make your present radio seem like a "crystal set"! Complete with optional battery eliminator for **both** battery and mains use! We're almost giving them away at only £20·75**—a mere fraction of even today's Russian miracle price!** We challenge you to compare performance and value with that of £80 radios! *Test 7 days—we'll refund instantly if you are not astounded after 7 days. **Elegant black and chrome finish facia, set in fabulous Cabinet built case—constructed of fine Russian hardwood in beautiful Teak Veneer finish—prevents vibration, ensures purer and sweeter tone than ever!** Volume controlled from a whisper to a roar that would fill a hall! **Much wider band spread, for absolute "pin-point" station selection! Plus "MAGIC EYE" tuning level indicator for ultra perfect tuning sensitivity!** Yes, the Russians have surpassed themselves, proving again their fantastic ability in the field of electronics and brilliantly reflecting their advanced micro-circuitry techniques in the field of spaceship and satellite communications. **Yes, EVERY WAVEBAND** instantly at your fingertips **including Standard Long, Medium, Short and Ultra Short Waves to cover the four corners of the earth 24 hours a day, including all normal transmissions, VHF, AM, FM, MW, LW, USW, plus local and new stations not yet operational and messages from all over the world! Expensive TURRET TUNER** side control waveband selection unit (as used on expensive T.V.'s!). Every waveband clicks into position giving incredible ease of station tuning! Genuine push-pull output! ON/OFF volume and separate Treble and Bass tone controls for utter perfection of reproduction and tone! **Press-button dial illumination! Take it anywhere**—runs economically on standard batteries (obtainable everywhere) or direct through battery eliminator from 220/240v AC mains supply. Internal ferrite rod aerial plus built-in "rotatable" telescopic aerial extending to 39ins approx. **It's also a fabulous CAR RADIO. Can also be used through extension amplifier, tape recorder or public address system. SIZE 14ins x 10½ins x 4½ins** overall approx. Magnificently designed, made to give **years of perfect service.** (U.K. service facilities and spares available for years and years to come, if ever necessary!). With WRITTEN GUARANTEE manual with simple operating instructions and circuit diagram. **ONLY £20·75** (with mains/battery eliminator £1·48 extra) **BOX, POST, ETC. 50p. *BUT WAIT, for only 55p extra** you get the sensational **"COMPUTERISED" WORLD TUNING GUIDE** (it enables you to time, pinpoint and get transmissions the whole world over—even a child can do it in a flash—**it even lets you know when to tune into the U.K. when abroad.** NO GUESSING! NO MESSING!) **PLUS Standard 'longlife' batteries PLUS ultra sensitive earphone for personal listening.** (Sorry—We cannot change these new radios for any earlier model purchased.) HURRY! Send today or call at either store. It's a chance of a lifetime that nobody can afford to miss. **SHOPERTUNITIES FOR BARGAINS!**

ANOTHER EAST EUROPEAN MIRACLE!

Fantastic 2-in-1 PERSONAL PORTABLE and CAR RADIO

NOW WORLD WIDE RECEPTION

IN YOUR CAR TOO! (RUNS OFF 12v. CAR BATTERY)

Position it for CAR RADIO, results will justify! OR detach & use carry handle for PORTABLE with its own batteries!

4 WAVEBAND VHF AM/FM/ LONG & SHORT WAVEBANDS

FANTASTIC PRICE £9·95 BOX, POST ETC. 45p.

TRY AND MATCH IT FOR UNDER £35!

FANTASTIC! Brand spanking new. Another East European Miracle! This incredible **2-in-1 Radio! First class makers**—because of our crazy price, contract stipulates **we must NOT mention name! Beautifully made.** 9 x 5 x 2¼ inches overall approx. Every up-to-date technological improvement. **15 SEMICONDUCTORS!** 9 Transistors, 5 Diodes and Stabiliser! **FOUR WAVEBANDS! Yes, VHF model with AM/FM Long and Short wavebands!** Will get stations **around the world,** including Standard Long, Medium and Short Wave, also local and new stations not yet operational! Built-in internal ferrite aerial plus 5 section 26in. swivel telescopic aerial. **On/Off/volume and tone controls. Clear Station Selector Dial. Waveband selector! Equally** wonderful in CAR or HOME! **TWO Tuning Dials** for flat or upright use as illustrated. **RUNS OFF 12 VOLT BATTERY! (AS A PORTABLE** it runs on standard batteries.) **PLUG IN 12 VOLT ADAPTOR JACK PROVIDED** and **automatically** cut out internal batteries, **using car battery only!** Don't **you** think it's miraculous? Span the Oceans and pull in hundreds of transmissions **day and night, including short wave—even in car! BUT WAIT**—simply remove Radio from car, "snap on" optional carry handle **AND YOU HAVE A DE-LUXE PORTABLE,** with additional upright tuning dial. **WRITTEN GUARANTEE. Only £9·95 box, post 45p. *Sprung all metal matching detachable carry handle** (as illus.) **AND set of batteries only 25p extra if required.** Match with sets costing £35 or more. Test 7 days, refund if not absoluttey delighted.

Send quickly to our Uxbridge Road address or call at either store. (COMMERCIAL TRAVELLERS PLEASE NOTE: Merchandising Office at Holborn stores.)

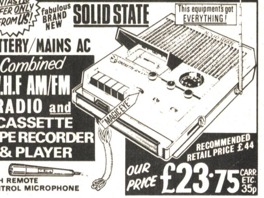
THIS FANTASTIC OFFER ONLY FROM US! SAVE £20·25 NOW!

fabulous BRAND NEW SOLID STATE

This equipment's got EVERYTHING!

BATTERY/MAINS AC Combined V.H.F AM/FM RADIO and CASSETTE TAPE RECORDER & PLAYER

WITH REMOTE CONTROL MICROPHONE



OUR PRICE £23·75 CARR. ETC. 35p

Shopertunities 'thunder' ahead with an offer that's **FANTASTIC** (even by our standards!) We've snapped up 500 magnificent machines. **Latest sensation in the world of sound!** First-class makers! Fabulous **VHF, AM/FM Radio AND Cassette Tape Recorder & Player combined and it also runs off standard batteries or mains.** (Simply plug in the 220/240v. AC line cord. Record and play back **anything, anywhere! Even tape direct from the Radio as you listen! RECOMMENDED RETAIL PRICE GENUINELY £44! WE OFFER AT ALMOST HALF PRICE!** Wonderful features: ★ **Press-button Keyboard Control Panel or latest MASTER SWITCH CONTROL!** ★ **"MAGIC EYE" Visual Battery check/recording level indicator or built-in automatic Leveller!** ★ **Separate ON/OFF and HI-LO volume controls!** ★ **Heavy duty built-in speaker!** ★ **Earphone** (for personal listening or "monitoring") **and extension speaker sockets!** ★ **Remote control microphone!** ★ **Built-in swivel telescopic extension aerial (24in. approx)! Magnificently made case with carry handle. (DESIGNS VARY SLIGHTLY.)** Takes standard 30, 60, 90 or 120-minute Cassette Tape that are obtainable everywhere. **The amazing built-in full circuit VHF, AM/FM Radio** gives you superb clarity of tone, incredible station selection. Unique rotating Station Selector Dial—get all local city and regional stations in every part of the country plus B.B.C. National, VHF. Picks up dozens of foreign stations. **Fabulous in your car!** You could pay £ £ £'s more for a Car Radio or Car Cassette player ALONE! **£23·75, CARR, ETC. 35p. Complete with simple instructions, remote control microphone with on/off switch and microphone stand. WITH WRITTEN GUARANTEE.** *Send today or call at either store.*

BONUS OFFER: Batteries and Cassette Tape 25p extra if required.

SHOPERTUNITIES LTD.

Dept. EE/13, 164 UXBRIDGE RD., LONDON, W12 8AQ (Thurs. 1, Fri. 7) (*facing Shepherd's Bush Green*). **Also 37 High Holborn, London W.C.1 (Thursday 7 p.m.). Both Mon. to Sat. 9 a.m.–6 p.m.**

TECHNICAL TRAINING
in radio television and electronics

Whether you are a newcomer to radio and electronics, or are engaged in the industry and wish to prepare for a recognized examination, ICS can further your technical knowledge and provide the specialized training so essential to success. ICS have helped thousands of ambitious men to move up into higher paid jobs—they can help you too! Why not fill in the coupon below and find out how?

Many diploma and examination courses available, including expert coaching for:

- **C. & G. Telecommunication Techns. Certs.**
- **Radio Amateurs' Examination**
- **General Radiocommunications Certificate.**
- **C. & G. Radio Servicing Theory.**
- **General Certificate of Education, etc.**

Now available, Colour T.V. Servicing

Examination Students coached until successful

NEW SELF-BUILD RADIO COURSES

Learn as you build. You can learn both the theory and practice of valve and transistor circuits, and servicing work while building your own 5-valve receiver, transistor portable, and high-grade test instruments, all under expert tuition. Transistor Portable available as separate course.

POST THIS COUPON TODAY

for full details of ICS courses in Radio, T.V. and Electronics

ICS INTERNATIONAL CORRESPONDENCE SCHOOLS

Dept. No. RA26, Intertext House, Stewarts Road, London, SW8 4UJ

Please send me the ICS prospectus—free and without obligation.

(state Subject or Exam.)..

NAME.. AGE...........

(Block Capitals Please)

ADDRESS ....

....

.... 2/72

Member of the ABCC *Accredited by the CACC*

INTERNATIONAL CORRESPONDENCE SCHOOLS

---

gspk (sales)
quite simply-the best

RESISTORS
FULL RANGE OF CARBON FILM RESISTORS

1/5 W (range 4·7 ohms to 470K)	1p each
½ W and ¼ W (range 4·7 ohms to 10 Megs)	1p each
1 W (range 4·7 ohms to 10 Meg)	2p each
2 W (range 4·7 ohms to 10 Meg)	3p each

These Miniature High Stability carbon Film Resistors have negligible noise factor.
All Resistors ± 5% (except values over 4·7 Meg). These Resistors are even lower in price than most 10% and older carbon composition types.

PRE-SET POTENTIOMETERS
Standard values of pre-sets from 100 ohms to 5 Meg.
Standard/miniature ...... 7p each Sub-miniature .... 5p each

SIEMENS PROFESSIONAL CAPACITORS

POLYCARBONATE AND POLYESTER			ELECTROLYTIC		
Voltage	Capacitance	Price	Voltage	Capitance	Price
100v	0·1 μF	6p	10v	22 μF	7p
100v	0·15 μF	6p	10v	470 μF	11p
100v	0·22 μF	6p	16v	47 μF	7p
100v	0·33 μF	9p	25v	10μF	7p
100v	0·47 μF	10p	25v	100 μF	9p
100v	0·68 μF	15p	25v	220 μF	11p
250v	0·01 μF	5p	25v	470 μF	14p
250v	0·015 μF	5p	25v	1000 μF	22p
250v	0·022 μF	5p	25v	2200 μF	42p
250v	0·033 μF	6p	35v	4·7 μF	7p
250v	0·047 μF	6p	35v	220 μF	14p
250v	0·068 μF	6p	100v	10 μF	8p
250v	0·1 μF	6p	100v	22 μF	9p
			100v	47 μF	14p

SPECIAL OFFER

Bumper Bundle of power transistors capacitors and diodes.

Retail value £5 Yours for only
£1·50 Offer valid for limited period only.

SEMICONDUCTORS
Here are just a few examples of our LOW Semiconductor prices. . . . . Many more semicons available all at equally sensational prices . . . . .NOW.

	1+	25+		1+	25+		+1	25+
AC127	24p	22p	BZY88C			OC76	22p	21p
AC128	19p	16p	Series E12			OC170	24p	21p
AC176	15p	13p	(2·7v–30·0v)	10p	9p	1N4001	6p	5p
ACY18	18p	15p	NKT210	24p	19p	1N4002	6p	5p
AD161	27p	25p	NKT211	24p	19p	1N4003	7p	6p
AD162	27p	25p	NKT212	24p	19p	1N4004	8p	7p
AF139	28p	26p	NKT213	24p	19p	1N4005	10p	9p
BC107	9p	8p	NKT214	19p	17p	1N4006	12p	11p
BC108	8p	7p	NKT218	24p	19p	1N4007	18p	16p
BC109	9p	8p	NKT219	24p	19p	1N4148	4p	3p
BC147	8p	7p	NKT223	26p	20p	2N1302	16p	15p
BC148	8p	7p	NKT224	21p	19p	2N1304	21p	20p
BC149	8p	7p	NKT242	14p	12p	2N1613	14p	13p
BCY70	14p	13p	NKT243	51p	44p	2N1711	15p	14p
BCY71	20p	19p	NKT401	70p	56p	2N2904	29p	28p
BCY72	14p	12p	NKT402	75p	59p	2N2905	24p	22p
BDY20	91p	73p	NKT403	64p	50p	2N2906	19p	18p
BFX29	24p	23p	NKT453	41p	33p	2N2907	22p	21p
BFX30	24p	23p	OA47	6p	5p	2N3053	17p	16p
BFY50	19p	18p	OA79	6p	5p	2N3054	49p	47p
BFY51	18p	17p	OA90	5p	4p	2N3055	57p	52p
BFY52	19p	18p	OC70	12p	12p	(BD130)		

NUMEROUS OTHER ITEMS AVAILABLE INCLUDE :
Switches Comprehensive range of N.S.F. Toggle switches and Rotary Wafer switch kits (to enable you to make *your own* switch to *your own* specification).
Copper laminate and all materials available to make your own printed circuit boards.
Lamps and lampholders for every requirement. **Ready Built Circuits and Modules.**
Freezer and Cleaner aerosol sprays.
Jack Plugs and sockets.
Variety of speciality products.
Recording Tape

All orders value £2 or over *post free*. Other orders please add 10p p & p. We only sell new products—do not confuse with 'seconds' or surplus stock. Because of our keen prices we regret the prices apply to U.K. and B.F.P.O. addresses only. Please fill in the coupon and send with 10p (refundable on ordering) for catalogue.

ALL CALLERS WELCOME

MON. TO FRI. 9-5.00

To GSPK (SALES) LIMITED, Dept. E.E.
Head Office, Hookstone Park, Harrogate, Yorkshire,
HG2 7BU.

Name ....

Address ....

....E.E.

TEACH-IN

End of Term Answers

Here are the answers to the test we set last month:

(1) To make an *npn* silicon transistor conduct, its base must be made 600mV positive with respect to its emitter.

(2) Generally speaking, you can reverse the types of transistors in a circuit and reverse the power supply polarity to compensate, provided you reverse **all** transistors and all other parameters are identical. You **cannot** substitute silicon for germanium or vice-versa.

(3) The power dissipation in TR1 is the potential difference between emitter and collector multiplied by the quiescent current flowing through the transistor.

First calculate $I_b = \frac{9-0{\cdot}6}{33{,}600} = \frac{8{\cdot}4}{33{,}600} = 0{\cdot}25\text{mA}$

We now find $I_c = I_b \times h_{FE} = 0{\cdot}25 \times 200 = 50\text{mA}$

Voltage drop across R2 $= I_c \times \text{R2} = 0{\cdot}05 \times 100 = 5\text{V}$

Therefore drop across TR1 $= 9 - 5 = 4\text{V}$

The power dissipation in TR1 is $= V \times I = 4 \times 0{\cdot}05 =$ 0·2W or 200mW

(4) (a) When the switch is opened, C1 tries to charge over the range of 9V. We want the time it takes to reach 4V. That is 5V from the fully charged state.

$t = \log_e \frac{V_{total}}{V_a} \times C \times R$ (See *Teach-In* Part 8)

so in our case $t = \log_e \frac{9}{5} \times 0{\cdot}000001 \times 1{,}000{,}000$

$= \log_e 1{\cdot}8 = 0{\cdot}59$ seconds

(b) It will take a longer time because as fast as the capacitor is being charged some of the charge will be leaking away.

(c) The charging time will be less if you increase the total driving voltage range.

$t = \log_e \frac{18}{14} = \log_e 1{\cdot}29 = 0{\cdot}25$ seconds

(5) The diode is sometimes needed to protect a transistor with low emitter/base reverse breakdown voltage. Its need is determined by this and supply voltage.

(6) If the "mark" is 50mS the "space" will be $\frac{50 \times 1}{10} = 5\text{mS}$ so the total period is 55mS. Hence the frequency $\left(f = \frac{1}{t}\right)$ is $\frac{1}{0{\cdot}055} = 18{\cdot}2\text{Hz}$.

(7) 4V r.m.s. gives $4 \times \sqrt{2}$ volts peak which is 5·65V either positive or negative going about the +2V level. Therefore peak maximum positive is $(2 + 5{\cdot}65) = +7{\cdot}65\text{V}$ and peak negative is $(2 - 5{\cdot}65) = -3.65\text{V}$.

(8) It would be better to use a germanium diode in a low voltage range meter. The 600mV forward drop of a silicon diode would be too significant in a range of 5V. For higher ranges greater than 30V, a silicon diode could be used without introducing significant error.

(9) The answer is transformer (c). Note that you do not have to have separate windings to get transformer action. A centre tapped coil can behave just like a transformer.

(10) Buy the 6·3V r.m.s. type. It will have a peak output of $6{\cdot}3 \times 1{\cdot}414 = 8{\cdot}8\text{V}$. After rectification and smoothing the output will fall by about 600mV on medium loads. Sometimes you can compensate for this drop by using alternative mains tappings on the primary. Set for 210V if you want a high output, or 250V if you want a lower output.

(11) First calculate the reactance of the coil and total circuit impedance at each frequency, then use these values in a potential divide operation. We show the calculation at 50Hz and the straight answers at 100Hz and 200Hz.

At 50Hz $X_L = 2\pi fL = 2 \times 3{\cdot}142 \times 50 \times 1{\cdot}5 = 472$ ohm

$Z = \sqrt{(R^2 + X_L{}^2)} = \sqrt{(1{,}000{,}000 + 222{,}000)} =$ 1,100 ohms

Therefore $V_{out} = \frac{10 \times 472}{1{,}100} = 4{\cdot}3\text{V}$ r.m.s. at 50Hz

At 100Hz $V_{out} = 6{\cdot}85\text{V}$ r.m.s. and at 200Hz 8·8V r.m.s.

(12) One would use the class B stage because the quiescent current drawn is very low and hence very little power is wasted. If the volume is set low, battery power is conserved.

(13) Class A output does not suffer from cross over distortion and hence, intrinsically, provides a better quality output but at the expense of a high quiescent power dissipation. In practice modern class B outputs give quite comparable quality outputs.

(14) You would lose low frequency response (hence lose bass frequencies) because the low capacitance of the microphone presents very high impedance to current flow at low frequencies. There is a greater potential divide effect at low frequency when connected to a low impedance amplifier input.

If a high input impedance is used the proportionate reduction in signal level so caused is less significant. Ideally the input impedance of an amplifier for use with a crystal microphone should be about 10 times the impedance of the microphone.

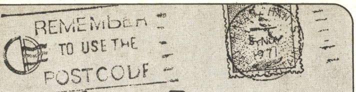
(15) Use the 15 ohm loudspeaker. You will not get maximum power coupling into it, but you will ensure that you do not exceed the current rating of the output transistors. As a general guide you can always use a loudspeaker having a higher impedance than that specified, but **never** use one that is lower.

(16) The errors were:

- (i) D1 was the wrong way round.
- (ii) TR2 emitter and collector were connected the wrong way round.
- (iii) The flying lead should have come from the positive rail.
- (iv) TR3 should be an *npn* and **not** *pnp* transistor.
- (v) C3 was shown the wrong way round.

Typical values are R1, R2: 5·6 kilohm; R3: 100 kilohm; R4: 330 ohm; C1, C2: 15,000pF; C3: 50μF; TR1, TR2, TR3: BC108; D1, D2: OA91, LS1: 35 ohm; B1: 9V.

For unity mark/space ratio at 500Hz, Rf should be 100 kilohms but it can be varied between 22 kilohms and 470 kilohms to produce different frequency notes.



Readers Letters

Temperature Measurement

In the August 1972 Editorial of E.E., reference is made of using the old British symbol for the resistor. I agree with the comment that the zigzag is superior to the oblong box, also for my own use I shall still think of c/s, Kc/s, Mc/s etc, rather than Hz, as I think c/s describes the frequency of alternating current far better than Hz.

Referring to the thermistor used in the Weather Station project, as I understand, it will give the temperature of the sunshine if placed in the sun, which will be higher than conventional themometers in a proper ventilated screen four feet above bare earth and at least four feet away from any building or tree. This should be borne in mind if comparing such a temperature reading with those published in local evening papers as these are usually taken from thermometers in proper ventilated screens.

If placed in the shade of a tree so that the sun did not shine on it at all during the day the reading would then be nearer to that of a thermometer in a proper screen, although if used in the complete station, the unit (whole) would have to lie in an open space to record wind direction and speed.

C. W. Hockney
Yorkshire.

Soldering

Your beginners series *Teach-In* suggests that in soldering, the soldering iron is applied to the work, and when the joint is sufficiently heated the solder applied to the joint i.e. the heated metal melting the solder. I have made reference to a book called "Soldering Handbook" which is (or was) published in association with Multicore solders. The book describes a similar technique to that which is printed on Multicore solder packets. This is as follows:

> "Applying the iron directly to the work to heat it is very inefficient, and merely oxidises the workpiece surfaces making them more difficult to solder. It is much better to apply cored solder to the work, and then melt the solder with the iron; this is the most efficient way of heating the work, by letting the solder and flux carry the heat from the soldering bit to the workpiece surface".

Multicore solders have this information in their packets so I am sure you will agree with me in saying that they must know what they are talking about!

There is a tremendous amount of confusion concerning soldering and its application, and in the case of beginners starting off on this hobby, it is surely very important that they learn in the correct manner. But which is the correct manner? I myself have been very confused and doubtful to whether my joints are of an acceptable quality, and I have been involved in electronic work for several years. So when it comes to beginners, a simple direct method should be employed where they definitely know what they are doing and given an assurance of good results.

Please comment on the two methods given, I feel the latter is the better but you may differ in opinion. Soldering being such an important part of electronics it is surely very important that beginners are taught correctly.

Paul Carvill
Wimbledon.

In our article on soldering (November 1971 issue—now unavailable) we said "A good soldered joint is made by first 'tinning' both surfaces . . . Unfortunately, copper oxidises very easily when heated . . . To prevent this oxidation we have to use a flux and this is contained in cores running through the length of the solder."

We went on to say, "The soldering iron, carrying a small amount of solder to help thermal contact, is then touched on the area to re-melt the solder on the surface and at the same time a small extra amount of cored solder is applied which runs into the joint."

As you have pointed out we did say that you should tin the wires by heating them with the iron and touching the solder on the wire. Provided the iron is carrying a small amount of solder to help thermal contact we believe this is better than melting the solder with the iron.

It is very easy for a beginner to melt the solder, without heating the job enough to ensure that the solder dissolves some of the copper wire and makes a good joint. If however the wire is heated until it melts the solder (using the solder on the iron to aid heat transfer) then the joint will be properly made.

Wavelength

In your radio tuner article, you stated that Radio 2, on long wave is on 200 metres. In fact 200 metres is the h.f. end of the medium wave band, Radio 2 being on 1500 metres, 200 kHz.

Are there any plans for valve equipment which I notice your magazine has not published.

K. Haley
Newcastle.

At present we do not intend to publish articles describing equipment using valves.

If you write to us for advice, and wish to have a personal reply you must include a s.a.e. Unfortunately, we cannot prepare special designs, circuits or wiring diagrams to meet individual requirements, nor can we supply back issues or answer queries concerning commercial equipment, or subjects or designs not published by us.

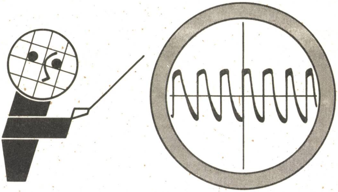
For all technical and editorial matters, write to: The Editor, Everyday Electronics, Fleetway House, Farringdon Street, London, E.C.4. Phone 01-634 4452.

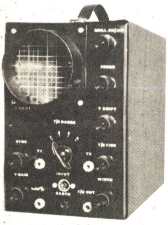
For all enquiries concerning advertisements or advertisers write to: The Advertisement Manager, Everyday Electronics, at the above address. Phone 01-634 4202.

look! electronics really mastered

... practical
... visual
... exciting!

no previous knowledge
no unnecessary theory
no "maths"





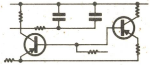
RAPY

BUILD, SEE AND LEARN
step by step, we take you through all the fundamentals of electronics and show how easily the subject can be mastered. Write for the free brochure now which explains our system.

1/ BUILD AN OSCILLOSCOPE

You learn how to build an oscilloscope which remains your property. With it, you will become familiar with all the components used in electronics.

2/ READ, DRAW AND UNDERSTAND CIRCUIT DIAGRAMS



as used currently in the various fields of electronics.

3/ CARRY OUT OVER 40 EXPERIMENTS ON BASIC ELECTRONIC CIRCUITS & SEE HOW THEY WORK, including:

valve experiments, transistor experiments amplifiers, oscillators, signal tracer, photo electric circuit, computer circuit, basic radio receiver, electronic switch, simple transmitter, a.c. experiments, d.c. experiments, simple counter, time delay circuit, servicing procedures.

This new style course will enable anyone to really understand electronics by a modern, practical and visual method—no maths, and a minimum of theory—no previous knowledge required. It will also enable anyone to understand how to test, service and maintain all types of electronic equipment, radio and TV receivers, etc.

FREE **POST NOW for BROCHURE**

or write if you prefer not to cut page

To: BRITISH NATIONAL RADIO & ELECTRONICS SCHOOL,
P.O. Box 156, JERSEY. **Please send your free brochure, without obligation, to:**
we do not employ representatives

NAME BLOCK CAPS

ADDRESS PLEASE EEL112

special free gift also to all our students

Eliminators

9 volt @ 20mA (PP3)	£1.25
6 volt @ 50mA	£1.50
9 volt @ 50mA	£1.50
6 + 6 volt, 50mA	£2.50
9 + 9 volt, 50mA	£2.50
7½ volt for cassette recorders	£2.00
6, 7½ or 9 volt	£3.00
3, 4½, 6, 7½, 9, 12 @ 500mA	£3.99
Car Battery Converter **fully stabilised** to provide 6, 7½ or 9 volts (illustrated)	£4.99

(p. & p. **15p.** on all types)

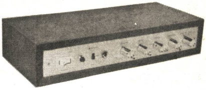
DIL Sockets

14 and 16 pin

16p

(including ZIG–ZAG)

THE TEXAN



Complete Kit (inc. Teak Case) **£28.50** P&P 45p

20 Watts per channel integrated stereo amplifier developed by engineers of 'Texas Instruments Ltd.' This designer approved kit, has a state-of-the-art specification, including distortion of only **0.09%** at **20 Watts** into **8 ohms** and a bandwidth of **5 – 35,000** at **–3db.** The semiconductor compliment of this superb kit includes no less than **6 integrated circuits,** 10 Silicon transistors, 4 rectifiers and 2 zeners. Controls include : bass; treble; volume; balance; on/off; 'on' indicator; headphone sockets; scratch filter; rumble filter; inputs for magnetic phono; tuner; aux or tape; tape head etc; input; selector; mono/stereo switch. The construction of this kit was featured in 'Practical Wireless' May - Aug. 1972.

Veroboard

	Copperclad 0.1"	Copperclad 0.15"	Plain 0.15"
2½" x 1"	6p	6p	–
2½" x 3¾"	20p	16p (9)	10p
2½" x 5"	24p	21p (7)	12p
3¾" x 3¾"	24p	21p (8)	–
3¾" x 5"	27p	27p (10)	17p
17" x 2½"	67p	50p	37p
17" x 3¾"	90p	70p	52p
17" x 5"	–	–	75p

Spot-face Cutter	36p
Pin Insertion Tool	47p
Terminal Pins	18p per pack of 36

Aluminium Boxes

Including baseplate and screws

No.	L.	W.	D.	Price	p. & p.
(7)	2¾"	x 5¼"	x 1½"	35p	8p
(8)	4"	x 4"	x 1½"	35p	8p
(9)	4"	x 2¾"	x 1½"	35p	8p
(10)	4"	x 5¼"	x 1½"	40p	8p
11	4"	x 2½"	x 2"	35p	8p
12	3"	x 2"	x 1"	32p	9p
13	6"	x 4"	x 2"	50p	10p
14	7"	x 5"	x 2½"	58p	12p
15	8"	x 6"	x 3"	75p	18p
16	10"	x 7"	x 3"	85p	20p

Resistors

½ watt 5% Carbon Film – low noise Hi-Stabs All E24 values **1p.** each plus p. & p. 7p. for up to 50 Resistors and a further 2p for each additional 50. Deduct **33 1/3%** for 100 of one type or **25%** for mixed orders over £1 in value.

1 watt	10%	Carbon Composition	3p. each
2 watt	10%	Carbon Composition	6p. each
2½ W	5%	Wire wound	9p. each
5 W		Wire wound	9p. each
10 W		Wire wound	10p. each

plus p. & p. 7p. for up to 25 resistors plus 1p. for each additional 25.

Semiconductors

AC107	25p	AF239	30p	BF197	15p	2N1304	22p	AA120	9p
AC126	17p	BC107	10p	BU105	£2	2N1893	30p	AA129	9p
AC127	15p	BC108	10p	MPF102	40p	2N2926	10p	BA100	15p
AC128	15p	BC109	10p	MPF103	37p	2N3053	23p	BA154	13p
AC176	20p	BC147	10p	MPF104	37p	2N3055	49p	BA155	14p
AC187	25p	BC148	10p	MPF105	40p	2N3702	12p	BA156	15p
AC187K	25p	BC149	10p	MPF106	45p	2N3704	17p	OA47	10p
AC188	25p	BC157	12p	OC28	40p	2N3819	35p	OA79	9p
AC188K	25p	BC158	10p	OC35	40p	IN914)	6p	OA81	7p
AD140	40p	BC159	12p	OC44	15p	IN4148)		OA90	7p
AD149	40p	BC169	15p	OC45	15p	IN4001	6p	OA91	7p
AD161)	60p	BF180	25p	OC71	11p	IN4002	7p	OA200	10p
AD162)		BF181	30p	OC72	17p	IN4003	8p	OA202	10p
AF114	18p	BF184	25p	OC170	23p	IN4004	8p	SL403D	£1.50
AF115	18p	BF185	25p	OC171	30p	IN4005	10p	μA709C	45p
AF116	18p	BF194	15p	2N697	18p	IN4006	12p	μA710	45p
AF117	18p	BF195	15p	2N706	12p	IN4007	15p	μA741C	50p
AF139	28p	BF196	15p	2N708	15p	AA119	9p	μA723C	£1.05

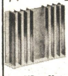
Thermistors

R53	£1.32
VA1005	15p
VA1026	13p
VA1033	13p
CZ1	15p
CZ4	13p
CZ13A	13p
GL16	£1.00
GL23	£1.00
A15B	75p

Heat Sinks

TO5
TO18
5p

TO66	14p
TO3	15p
Power Tab	13p



10D 50p

DIP10/2
for SL403D
15p

CHROMASONIC electronics

Capacitors

Mylar - 100V

1000pf	2p	0.04μF	3p
2000pf	2p	0.05μF	3p
5000pf	2p	0.068μF	4p
0.01μF	3p	0.1μF	4p
0.02μF	3p	0.2μF	5p

Polystyrene - 160V

10pf to 10,000pf all **3p.** each in multiples of 10, 15, 22, 33, 47 & 68.

Mullard C280 - 250V

0.01μF	3p	0.22μF	5p
0.015μF	3p	0.33μF	6½p
0.022μF	3p	0.47μF	8p
0.033μF	3p	0.68μF	11p
0.047μF	3p	1μF	13p
0.068μF	3½p	1.5μF	20p
0.1μF	4p	2.2μF	24p
0.15μF	4p		

Mullard C281 - 400V

0.01μF	4½p	0.1μF	7p
0.015μF	4½p	0.15μF	8p
0.022μF	4½p	0.22μF	10p
0.033μF	5½p	0.33μF	14p
0.047μF	6p	0.47μF	15p
0.068μF	6p		

Mullard C426,015 &016 all 6p each

Voltage			10	16	25	40	63
2.5	4	6.4	10	16	25	40	64
Capacity μF			22	15	10	6.8	1
			47	68	22	47	2.2
			100	150	47	100	4.7
			220		100		10
					150		
10	8	6.4	4	2.5	1.6	1	0.64
40	32	25	16	10	6.4	4	2.5
80	64	50	32	20	12.5	8	5
160	125	100	64	40	25	16	10
320	250	200	125	80	50	32	20
500	400	320	200	125	80	50	32

Mullard C437 & 017

2.5	4	6.4	10	16	25	40	64	
1000	800	640	400	250	160	100	64	8p
1600	1250	1000	640	400	250	160	100	10p
2500	2000	1600	1000	640	400	250	160	13p
4000	3200	2500	1600	1000	640	400	250	16p
			470		220			10p
					470			12p
			1500	1000	680	470		18p

We also hold:

Mullard C333 ceramics 1.8pf – 330pf 63V.	5p
Silvered Mica 1%; 500V; 2.2pf – 820pf	7p
Feedthrough ceramic 1000pf; 350V.	5p

Disc ceramics, monolithic ceramic, high voltage types; tantalums etc.

Mullard C431

10	16	25	40	64	
2000	1250	800	500	320	33p
3200	2000	1250	800	500	40p
5000	3200	2000	1250	800	50p
10000	6400	4000	2500	1600	74p
16000	10000	6400	4000	2500	93p

HT Electrolytics

1; 2; 4; 8μF	450V	14p
16μF	450V	15p
32μF	450V	20p
50μF	350V	20p

TV & Radio Types

8 + 8μF; 450 V.W	18p	32 + 32μF; 350 V.W	25p
8 + 16μF, 450 V.W	20p	32 + 32μF; 450 V.W	43p
16 + 16μF; 450 V.W	25p	50 + 50μF; 350 V.W	35p
16 + 100 + 100 + 300μF; 275 V.W.	£1.23		
32 + 100 + 125 + 200μF; 275 V.W.	£1.23		
32 + 100 + 200 + 200μF; 300 V.W.	£1.23		
100 + 100 + 100 + 150 + 150μF; 320 V.W.	£1.66		
100 + 100 + 200 + 300μF; 275 V.W.	£1.23		
60+100+200μF; 300 V.W	93p		
100+200+200μF; 300 V.W	£1		
100+200μF; 275 V.W	75p		
100+400μF; 275 V.W	£1.15		
200μF; 275 V.W.	50p	300+300μF; 300 V.W	£1.90

MAIL ORDERS: Where no p. & p. charge is shown, a minimum of **7p.** applies. P. & P. on overseas orders is charged at cost

ADDRESS TO: **Mail Order Dept.,**
56, Fortis Green Road, London, N10 3HN.
TELEPHONE: 01-883 3705

Potentiometers

5KΩ	50KΩ	500KΩ
10KΩ	100KΩ	1MΩ
25KΩ	250KΩ	2MΩ

log or lin less switch	12p
log or lin with switch	24p
dual less switch	40p
dual with switch 10K, 100K & 1M log only	52p
10K log + 10K antilog less switch	40p

Slider Pots

Single	Dual	
10K	10 + 10K	log or lin
25K	25 + 25K	
50K	50 + 50K	
100K	100 + 100K	
30p	50p	

Knobs 10p.

Presets

Vertical or Horizontal

0.1 watt **5p** 0.25 watt **7p**

100	1K	10K	100K	1M
250	2.5K	25K	250K	2.5M
500	5K	50K	500K	5M

Why take the risk?

of damage to expensive transistors and integrated circuits, when soldering?

Use Antex low-leakage soldering irons

as selected for the DESIGN CENTRE LONDON

220-240 Volts or 100-120 Volts

Model X25

The leakage current of the NEW X25 is only a few microamps and cannot harm the most delicate equipment even when soldered "live". Tested at 1500v. A.C. This 25 watt iron with it's truly remarkable heat-capacity will easily "out-solder" any conventionally made 40 and 60 watt soldering irons, due to its unique construction advantages. Fitted long-life iron-coated bit 1/8".

2 other bits available 3/32" and 3/16".

Totally enclosed element in ceramic and steel shaft Bits do not "freeze" and can easily be removed

PRICE: £1.75 (rec. retail)

Suitable for production work and as a general purpose iron

Model CCN

220 volts or 240 volts

The 15 watt miniature model CCN. also has negligible leakage. Test voltage 4000v. A.C. Totally enclosed element in ceramic shaft. Fitted long-life iron-coated bit 3/32"

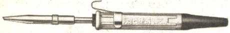
4 other bits available 1/8", 3/16" 1/4" and 1/16"

PRICE: £1.80 (rec. retail)

OR Fitted with triple-coated, (iron, nickel and Chromium) bit 1/8"

PRICE: £1.95 (rec. retail)

A SELECTION OF OTHER SOLDERING EQUIPMENT.



MODEL CN

Miniature 15 watt soldering iron fitted 3/32" iron-coated bit. Many other bits available from 3/64" to 3/16". Voltages 240, 220, 110, 50 or 24

PRICE: £1.70 (rec. retail)

MODEL CN2

Miniature 15 watt soldering iron fitted with nickel plated bit 3/32". Voltages 240 or 220.

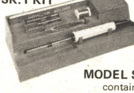
PRICE: £1.70 (rec. retail)

MODEL G

18 Watt miniature iron, fitted with long life iron-coated bit 3/32". Voltages 240, 220 or 110.

PRICE. £1.83 (rec. retail)

MODEL SK.1 KIT



contains 15 Watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32", heat sink, solder, stand and "How to Solder" booklet.

PRICE £2.75 (Rec. retail)

MODEL SK.2 KIT

contains 15 Watt miniature iron fitted with 3/16" bit, 2 spare bits 5/32" and 3/32" heat sink, solder and booklet "How to Solder"

PRICE £2.40 (Rec. retail)

MODEL MES.KIT Battery-operated 12v. 25 watt iron fitted with 15' lead and 2 heavy clips for connection to car battery. Packed in strong plastic wallet with booklet "How to Solder." **PRICE £1.95 (Rec. retail)**

A N T E X

From radio or electrical dealers, car accessory shops or, in case of difficulty direct from:–
ANTEX LTD. FREEPOST
(no stamp required) **Plymouth**
PL1 1BR Tel: 0752 67377

☐ Please send the ANTEX colour catalogue.

☐ Please send the following:

____

____

____

____

I enclose cheque/P.O./Cash (Giro No. 2581000)

____

NAME ______________________

ADDRESS ______________________

____

EE11

BODINE TYPE N.C.I. GEARED MOTOR

(Type 1) 71 r.p.m. Torque 10lb. inch. **Reversible.** 1/70th h.p. 50 cycle, 0·38 amp (**Type 2**) **28 r.p.m.** Torque 20lb inch. **Reversible.** 1/80th h.p., 50 cycle, 0·28 amp. "As new" condition. Input voltage of motor 115V a.c. Supplied complete with transformer for **230/240V a.c. input.** Price, either type **£3·50** plus 35p P. & P. or less transformer **£2·25** plus 27p P. & P.

CONSTANT SPEED, PRECISION MADE 6 VOLT D.C. GOVERNED MOTOR

Seven pole armature, ballrace bearing. 2,750 r.p.m. Length 2 11/16, Dia 11/16, Shaft length 5/16, Shaft dia. 5/64. No load 40 mA. Normal load 350 mA. Price **£1·25** P. & P. 10p.

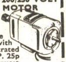
230V/240V COMPACT SYNCHRONOUS GEARED MOTORS

Manufactured by either Sangamo, Haydon or Smith. Built-in gearbox.

5 R.P.M. A/cw 1 R.P.H. A/cw 9 R.P.H. cw
2 R.P.H. cw 12 R.P.H. cw
3 R.P.H. A/cw 20 R.P.H. cw

cw=Clockwise. A/cw=Anti-clockwise.
Fraction of makers' price. All at **75p** incl. P.&P.

PARVALUX TYPE SD2. 200/250 VOLT A.C. D.C. HIGH SPEED MOTOR



Speed 9,000 r.p.m. approx. or 3,200 r.p.m. if used with built in governor, or variable speed over a wide range if used in conjunction with our Dimmer Switch, illustrated below. PRICE: **£1·75** P. & P. 25p
Other models available on request.

600 WATT DIMMER SWITCH

Easily fitted. Fully guaranteed by makers. Will control up to 600W of all lights except fluorescent at mains voltage. Complete with simple instructions. **£3** incl. P. & P.

PROGRAMME TIMERS

240v A.C. 5 r.p.m. motor. 2 models available with either 10 cams or 15 cams. Each cam operating a 10 amp c/o micro switch. Cams are individually variable, allowing innumerable combinations. Ideally suited for machinery control, automation, etc. Also in the field of entertainment, for chaser lights, animated displays, etc. NEW 10 cam **£4·75** p. & p. 25p. 15 cam **£5·75** p. & p. 25p.

ELECTRONIC ORGAN KIT

Easy to build. Solid State. Two full octave (less sharps and flats). Fitted hardwood case. Powered by two penlite 1½V batteries. Complete set of parts including speaker, etc., together with full instructions and 10 tunes. Price **£3·00.** P. & P. 22p.

50 in 1 ELECTRONIC PROJECT KIT

50 easy to build Projects. No soldering, no special tools required. The kit includes Speaker, Meter, Relay, Transformer, plus a host of other components and a 56-page instruction leaflet. Some examples of the 50 possible Projects are: Sound Level Meter, 2 Transistor Radio, Amplifier, etc. Price **£7·75.** P. & P. 30p.

CRYSTAL RADIO KIT

Complete set of parts, including: Crystal Diode, Ferrite Aerial, Drilled Chassis, and Personal Ear Piece. No soldering, easy to build, full step by step instruction. **£1·75** inc. post.

VENNER Electric Time Switch

200/250V Ex. GPO. Tested. Manually set 2 on, 2 off every 24h. Override switch: 10A **£2·75,** 15A **£3·25,** 20A **£3·75.** 30A **£3·95.** P. & P. 20p. Also available with solar dial ON dusk, OFF dawn. Price as above.

VARIABLE VOLTAGE TRANSFORMERS

INPUT 230/140V a.c. 50/60 OUTPUT VARIABLE 0.260V from ½ to 50 amp stock.

SHROUDED TYPE

1 amp, £7·00 2·5 amp, £8·05
5 amp, £11·75
10 amp, £22·50 20 amp. £49·00
15 amp, £25·00 25 amp, £58·00
37·5 amp. £82·00 50 amp, £98·00

OPEN TYPE (Panel Mounting) ½ amp. **£4·75.**
1 amp, **£7.00** 2½ amp. **£8·05.** All types carriage paid.

Superior Quality Precision Made NEW POWER RHEOSTATS

100 WATT. 1 ohm, 10A; **5 ohm,** 4·7A; **10 ohm,** 3A; **25 ohm,** 2A; **50 ohm,** 1·4A; **100 ohm,** 1A; **250 ohm,** 0·7A; **500 ohm,** 0·45A; **1 kΩ,** 280 mA; **1·5 kΩ,** 230mA; **2·5 kΩ,** 0·2A; **3·5kΩ,** 165mA **5 kΩ,** 140mA. Diameter 3¼in Shaft length ⅞in, dia. 15/64 in. All at **£1·65** each. P. & P. 7½p.
50 WATT. 1/5/10/25/50/100/250/500/1k/1·5k/2·5k/5kΩ. **All at £1·15 each.** P. & P. 7½p.
25 WATT. 10/25/50/100/250/300/500/1k/1·5k/2·5k/3·5kΩ. **All at 90p each.** P. & P. 7½p.

STROBE! STROBE! STROBE!

Build a Strobe Unit, using the latest type Xenon white light flash tube. Solid state timing and triggering circuit. 230/250V a.c. operation.

EXPERIMENTERS' ECONOMY KIT
Speed adjustable 1 to 36 Flash per sec. All electronic components including Veroboard S.C.R. Unijunction Xenon Tube and instructions **£6·30,** plus 25p P. & P.

NEW INDUSTRIAL KIT
Ideally suitable for schools, laboratories, etc. Roller tin printed circuit. New trigger coil, plastic thyristor. Speed adjustable 1-80 f.p.s. Price **£10·50.** P. & P. 50p.

HY-LYGHT STROBE MK III
Designed and produced for use in large halls and utilises a silica tube printed circuit. Speed adjustable 0–30 f.p.s. Light output approx. 4 joules. **£12·00.** P. & P. 50p.

SPECIALLY DESIGNED. FULLY VENTILATED METAL CASE. Including reflector. **£4·00** P. & P. 45p. Post paid with kit.

THE 'SUPER' HY-LYGHT KIT

Approx. four times the light output of our well proven Hy-Lyght strobe. Incorporating:
- Variable speed from 1-23 flash per sec.
- Reactor control circuit producing an intense white light.

Never before a Strobe Kit with so HIGH an output at so LOW a price. ONLY **£20** plus 75p P. & P.

ATTRACTIVE, ROBUST, FULLY VENTILATED METAL CASE specially designed for the Super Hy-Lyght Kit including reflector **£7·00** P. & P. 45p.

7-inch POLISHED REFLECTOR
Ideally suited for above Strobe kits. Price **53p,** P. & P. 13p or post paid with kits.

6 IN COLOUR WHEEL as used for disco lighting effects etc. **£5·75** incl. P. & P. can be operated from our 1 rpm synchronous motor **75p** incl. P. & P.

RELAYS

New SIEMENS PLESSEY, etc. Miniature Relays at competitive prices.

1	2	3	4	1	2	3	4
52	3–6	2 c/o	**63p***	700	15–35	2 c/o HD	**73p***
280	9–12	2 c/o	**73p***	700	16–24	6M	**65p***
410	10–18	4 c/o	**73p***	1,250	24–36	4 c/o	**63p***
700	16–24	4M 2B	**63p***	2,500	36–45	6M	**63p***
700	16–24	4 c/o	**78p***	2,400	30–48	4 c/o	**50p**
700	12–24	2 c/o	**63p***	9,000	40–70	2 c/o	**50p***
700	6–12	1 c/o HD	**50p***	15k	85–110	6M	**50p***
700	22–30	6 c/o	**75p**				

(1) Coil ohms; (2) Working d.c. volts; (3) Contracts; (4) Price (HD) Heavy Duty. All Post Paid. *Including Base.

12 VOLT D.C. RELAY 140 OHM COIL
Three sets c/o contacts rated at 5 amps. **78p** incl. P. & P. (Similar to illustration below.)

'DIAMOND H' 230 VOLT A.C. RELAYS
Three sets c/o contacts rated at 5 amps. Price: **50p** P & P 10p. (100 lots **£40·00** incl. P & P.) **(UNUSED)**

'KEY SWITCH' 230 VOLT A.C. RELAYS
One set c/o contacts rated at 7·5 amps. BOXED. Price: **40p.** P & P 5p .(100 lots **£32·00** incl. P & P.)

MINIATURE LATCHING RELAY
Manufactured by Clare-Elliott Ltd. (Type F). 2 c/o permanent latching in either direction. Coil 1150 ohm, 15-30 Volt D.C. Size ⅞" high ¾" wide, ⅜" thick. Complete with 3" leads. New **73p.** incl. P. & P.

MICRO SWITCH—very special offer
5 amp c/o contacts. Fitted with removable push button assembly. Ex. P.O. 20 for **£1** inc. post. (Min. order 20).

"HONEYWELL" LEVER OPERATED MICRO SWITCH
15 amps. 250 volt A.C. c/o contacts. NEW in maker's Carton. Price: 10 for **£1·90** incl. P. & P.

SERVICE TRADING CO

All Mail Orders—Also Callers—Ample Parking Space
Dept. E.E. 57 Bridgman Road, Chiswick, London, W4 5BB
Phone 01-995 1560 **SHOWROOM NOW OPEN MON.-FRI.**

Personal callers only. Open Sat.
9 LITTLE NEWPORT ST.
LONDON WC2H 7JJ 01-437 0576

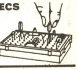
SINCLAIR PROJECT 60

Z30	**£3·50**
Z50	**£4·25**
PZ5	**£3·97**
PZ6	**£6·26**
PZ8 with trans	**£7·60**
AFU	**£4·50**
Stereo 60	**£7·80**
Project 605	**£19·00**

PROJECT 60 KIT £2·50

Our extremely popular kit contains the extra capacitors. DIN plugs and sockets, cables and fuse holder needed to complete Project 60.

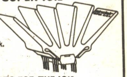
S-DECS AND T-DECS



S-DECS	**£1·40**
T-DECS	**£2·80**
μ-DEC A	**£3·00**

Official credit orders from educational establishments welcome.

SINCLAIR SUPER IC12



Complete with free printed circuit board and 44 page instruction book.

ONLY £1·80

KITS OF PARTS FOR THE IC12
Includes all parts for the printed circuit and volume bass and treble controls needed to complete the mono version **£1·30.** Stereo version with balance control **£3·00.**

POWER UNITS FOR THE IC12
A set of components to construct a 30V, 0·5 Amp power supply **£2·27.** Also suitable Sinclair PZ5 fully constructed **£3·97.**

SWANLEY ELECTRONICS
32 Goldsel Road, Swanley, Kent

Mail order only. Postage 10p per item.
Our Hi-Fi colour catalogue is 10p post free.

EX COMPUTER PRINTED CIRCUIT PANELS
2in × 4in packed with semi-conductors and top quality resistors, capacitors, diodes, etc. Our price 10 boards **50p,** P. & P. 7p. With a guaranteed minimum of 35 transistors. Data on transistors included.

SPECIAL BARGAIN PACK. 25 boards for **£1,** P. & P. 18p. With a guaranteed minimum of 85 transistors. Data on transistors included.

PANELS with 2 power transistors similar to OC28 on each board—components 2 boards (4 × OC28) **50p,** P. & P. 6p.

9 OA5, 3 OA10, 3 Pot Cores, 26 Resistors, 14 Capacitors, 3 GET 872, 3 GET 872B, 1 GET 875. All long leaded on panels 13in × 4in. 4 for **£1,** P. & P. 25p.

709C OPERATIONAL AMPLIFIER TO5
8 lead I.C. 1 off **50p.** 50 off **35p.**
100 off **20p.**

250 MIXED RESISTORS 62p
¼ and ½ watt.

150 MIXED HI STABS 62p
¼, ½ and 1 watt 5% and better.

QUARTZ HALOGEN BULBS
With long leads. 12V 55W for car spot lights, projectors, etc. **50p** each, P. & P. 5p.

GPO EXTENSION TELEPHONES
with dial but without bell. **95p** each, P. & P. 30p, **£1·75** for 2, P. & P. 50p.

BARGAIN RELAY OFFER
Single pole change over silver contacts 25V to 50V. 2·5k Ω coil. 8 for **50p,** P. & P. 5p.

KEYTRONICS mail order only

44 EARLS COURT ROAD

LONDON, W.8 **01-478 8499**

FOR RAPID SERVICE

GARLAND BROS. LTD,

DEPTFORD BROADWAY, LONDON, SE8 4QN

TRANSFORMERS

all with 0–250 Volt primaries

Miniature

MM6 6V, 500mA + 6V, 500mA
MM12 12V, 250mA + 12V, 250mA
MM20 20V, 150mA + 20V, 150mA
£1·29 plus 13p p. & p.

L.T.

LT1 6·3V, 1·5A—**75p** plus 18p p. & p.
LT2 6·3V, 3A—**80p** plus 26p p. & p.
LT3 12V, 1·5A—**80p** plus 26p p. & p.
LT4 12V, 3A—**£1·32** plus 30p p. & p.
LT5 9–0–9V, 0·5A—**75p** plus 21p p. & p.
LT6 12–0–12V, 1A—**95p** plus 26p p. & p.
LT7 30–0–30V, 1A—**£1·87** plus 30p p. & p.

Multi-tapped

MT30/2 0–12–15–20–24–30V, 2A—**£1·95** plus 30p p. & p.
MT60/1 0–5–20–30–40–60V, 1A—**£1·97** plus 30p p. & p.
MT60/2 0–5–20–30–40–60V, 2A—**£2·90** plus 34p p. & p.

Charger

CT/01 1A—**£1** plus 26p p. & p.
CT/02 2A—**£1·25** plus 30p p. & p.
CT/03 4A—**£1·50** plus 30p p. & p.
Secondaries—0–5–11–17V.

SEMICONDUCTORS, etc.

Zeners—400mW, **15p**; 1·5W, **22½p**
L.D.R.—ORP12, **56p**
S.C.R.—400 P.I.V., 3·0A, **57p**
Bridge rectifier—40 P.I.V., 1·5A, **50p**
Bridge rectifier—200 P.I.V., 2·0A, **50p**
Transistor sockets—**6p**
D.I.L. I.C. sockets—14 pin, **20p** 16 pin, **20p**
1N4001—50 P.I.V., 1·0A, **6p**
1N4002—100 P.I.V., 1·0A, **7p**
1N4003—200 P.I.V., 1·0A, **8p**
1N4004—400 P.I.V., 1·0A, **9p**
1N4005—600 P.I.V., 1·0A, **12p**

ALUMINIUM BOXES

with lids and screws

Type	L.	W.	D.	Price	p. & p.
GB7 *	5¼in	2¾in	1½in	**38p**	15p
GB8 *	4in	4in	1½in	**38p**	15p
GB9 *	4in	2¾in	1½in	**38p**	13p
GB10*	5¼in	4in	1½in	**44p**	18p
GB11	4in	2½in	2in	**38p**	13p
GB12	3in	2in	1in	**33p**	13p
GB13	6in	4in	2in	**52p**	18p
GB14	7in	5in	2½in	**63p**	19p
GB15	8in	6in	3in	**81p**	26p
GB16	10in	7in	3in	**92p**	26p

* These sizes fit standard veroboards

EQUIPMENT CASES

with sloping front panel

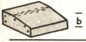
Type	H.	W.	D.	Price	p. & p.
SF1	2in	5¾in	2½in	**45p**	12p
SF2	2in	7¾in	3½in	**60p**	16p
SF3	2in	9¾in	4½in	**75p**	19p

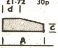
Plain aluminium. Stove - enamelled silver-grey hammer finished, **20p** extra.

CONSOLE CASES

in plain aluminium, ideal for mixers, instruments, etc.

Type	W. in	A in	B in	C in	D in	Price	p. & p.
GB20	8	9	3½	2	3	**£1·42**	30p
GB21	10	9	3½	2	3	**£1·58**	30p
GB22	12	9	3½	2	3	**£1·72**	30p





VEROBOARD

Size	0·1 matrix	0·15 matrix
2½in × 3¾in	22p	16p
2½in × 5in	24p	25p
3¾in × 3¾in	24p	25p
3¾in × 5in	27p	29p
17in × 2½in	75p	57p
17in × 3¾in	£1	75p

Pins—either size; packet of 36, 18p

ELECTROLYTICS

1µF	450V	**19p**	1,000µF	25V	**27p**
2µF	450V	**20p**	1,000µF	50V	**39p**
4µF	350V	**14p**	2,000µF	25V	**36p**
8µF	450V	**16p**	2,000µF	50V	**53p**
16µF	450V	**17p**	2,500µF	25V	**45p**
25µF	25V	**7p**	2,500µF	50V	**60p**
25µF	50V	**8p**	3,000µF	25V	**48p**
32µF	450V	**24p**	5,000µF	25V	**55p**
50µF	50V	**10p**	5,000µF	50V	**98p**
100µF	25V	**10p**	8–8µF	450V	**18p**
100µF	50V	**10p**	8–16µF	450V	**20p**
250µF	25V	**12p**	16–16µF	450V	**27p**
250µF	50V	**17p**	16–32µF	450V	**63p**
500µF	25V	**18p**	32–32µF	450V	**49p**
500µF	50V	**25p**	50–50µF	350V	**38p**

MINIATURE ELECTROLYTICS

1µF	63V	**6p**	47µF	16V	**7p**
2·2µF	63V	**6p**	47µF	25V	**6p**
3·3µF	63V	**6p**	68µF	16V	**6p**
4·7µF	63V	**6p**	100µF	10V	**6p**
8µF	40V	**7p**	220µF	16V	**7p**
10µF	25V	**6p**	330µF	16V	**11p**
10µF	64V	**7p**	470µF	10V	**11p**
16µF	40V	**7p**	1,000µF	16V	**19p**
30µF	15V	**7p**	1,500µF	16V	**23p**

CASSETTE OWNERS!

For Philips and similar cassette recorders.

PU12 Power unit for connection to 12V + or − E car electrical systems, giving 7½V, stabilised output. **£3·25**

PU14 As above but switched for 6V, 7½V or 9V output. **£5·10**

PP75 Mains power supply, output 7½V d.c. **£1·95**

All units are complete with cable and plug.

VARIABLE POWER SUPPLY

Input: 240V, a.c.
Output: Switched 3, 4·5, 6, 7·5, 9, 12 volts d.c. at 500mA **£4·20**

BATTERY ELIMINATORS

suitable for transistor radios and similar light current equipment

PP6 Input 240V a.c. Output 6V d.c.
PP9 Input 240V a.c. Output 9V d.c.
Price **£1·50** plus 12p p. & p.

NEW NEW

ILLUSTRATED 1972-73 CATALOGUE

Post Free 15p

CONTROLS, Log. or Lin.

Single, less switch, **15p**
Single, D.P. switch, **24p**
Tandem, less switch, **40p**
5kΩ, 10kΩ, 25kΩ, 50kΩ, 100kΩ, 250kΩ, 500kΩ, 1MΩ, 2MΩ

SLIDER CONTROLS, 87mm.

complete with knobs.
Single, **44p**; Tandem, **55p.** 10kΩ, 25kΩ, 50kΩ, 100kΩ, log. or lin.

RESISTORS

Carbon

All 5%, high-stability, E12 values. ¼W, **1p**; ½W, **1½p**; 1W, **4p**; 2W, **6p**

Wire-wound

5W, **10p**; 10W, **12p**

LOUDSPEAKERS

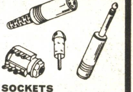
7in × 4in, 3Ω—**£1·12**, 8Ω—**£1·12**, 15Ω—**£1·40.**
8in × 5in, 3Ω—**£1·85**, 8Ω—**£1·77**, 15Ω—**£1·70.**
10in × 6in, 3Ω—**£2·32**, 8Ω—**£2·32**, 15Ω—**£2·32.**
8in round, 3Ω—**£2·10**, 8Ω—**£2·65**, 15Ω—**£2·10.**
Adastra "Hi-Ten", 10in, 10W, 8 or 15Ω—**£3·40.**
Please add 20p p. & p. to all speakers.

BONDED ACRYLIC FIBRE

B.A.F. wadding, 18in wide, 1in thick. The ideal lining for speaker enclosures. **25p** per yard.

PLUGS

Car aerial	**14p**
Co-axial	**9p**
D.I.N. 2 pin (speaker)	**10p**
D.I.N. 3 pin	**13p**
D.I.N. 4 pin	**14p**
D.I.N. 5 pin, 180°	**13p**
D.I.N. 5 pin, 240°	**15p**
D.I.N. 6 pin	**15p**
Jack, 2½mm unscreened	**9p**
Jack, 2½mm screened	**10p**
Jack, 3½mm unscreened	**8p**
Jack, 3½mm screened	**12p**
Jack, ¼in unscreened	**12p**
Jack, ¼in screened	**20p**
Jack, stereo, unscreened	**20p**
Jack, stereo, screened	**35p**
Phono, plastic top	**5p**
Phono, plated metal	**12p**
Phono, fitted 4 ft lead	**8p**
Wander, red or black	**3p**
Banana 4mm, red or black	**6p**



LINE SOCKETS

Car aerial	**14p**
Co-axial	**17p**
D.I.N. 2 pin (speaker)	**15p**
D.I.N. 3 pin	**16p**
D.I.N. 5 pin, 180°	**16p**
D.I.N. 5 pin, 240°	**16p**
Jack, 3½mm	**15p**
Jack, ¼in screened	**49p**
Jack, stereo, screened	**30p**
Phono, plated metal	**14p**

SOCKETS

Car aerial	**8p**
Co-axial, surface	**8p**
Co-axial, flush	**9p**
D.I.N. 2 pin (speaker)	**10p**
D.I.N. 3 pin	**9p**
D.I.N. 5 pin, 180°	**9p**
D.I.N. 5 pin, 240°	**9p**
Jack, 2½mm	**10p**
Jack, 3½mm	**10p**
Jack, ¼in unswitched	**15p**
Jack, ¼in switched	**17p**
Jack, stereo, switched	**24p**
Phono, single	**5p**
Phono, 2 on a strip	**7p**
Phono, 3 on a strip	**9p**
Phono, 4 on a strip	**10p**
Wander, single, red or black	**5p**
Wander, twin strip	**7p**
Banana 4mm red, or black	**6p**

CAPACITORS

2·2pF	500V	S/M	**7½p**
3·3pF	500V	S/M	**7½p**
5pF	500V	S/M	**7½p**
10pF	125V	P.S.	**5p**
10pF	500V	S/M	**7½p**
15pF	125V	P.S.	**5p**
15pF	500V	Cer.	**4p**
18pF	500V	S/M	**7½p**
22pF	125V	P.S.	**5p**
22pF	500V	S/M	**7½p**
25pF	500V	S/M	**7½p**
27pF	500V	Cer.	**4p**
33pF	125V	P.S.	**5p**
33pF	500V	S/M	**7½p**
39pF	500V	S/M	**7½p**
47pF	125V	P.S.	**5p**
47pF	500V	Cer.	**4p**
50pF	500V	S/M	**7½p**
56pF	500V	S/M	**7½p**
68pF	125V	P.S.	**5p**
68pF	500V	S/M	**7½p**
75pF	500V	S/M	**7½p**
82pF	500V	S/M	**7½p**
100pF	125V	P.S.	**5p**
100pF	500V	S/M	**7½p**
100pF	500V	Cer.	**5p**
120pF	500V	S/M	**7½p**
150pF	125V	P.S.	**5p**
150pF	500V	S/M	**7½p**
150pF	500V	Cer.	**5p**
180pF	500V	S/M	**7½p**
200pF	500V	S/M	**7½p**
220pF	125V	P.S.	**5p**
220pF	500V	Cer.	**5p**
250pF	500V	S/M	**8p**
270pF	500V	Cer.	**5p**
300pF	500V	S/M	**8p**
330pF	125V	P.S.	**5p**
330pF	500V	S/M	**8p**
390pF	500V	S/M	**8p**
470pF	125V	P.S.	**5p**
470pF	750V	Disc	**5p**
500pF	500V	S/M	**8p**
560pF	500V	S/M	**8p**
680pF	125V	P.S.	**6p**
680pF	500V	S/M	**8p**
820pF	500V	S/M	**8p**
0·001µF	100V	Mylar	**3p**
0·001µF	125V	P.S.	**6p**
0·001µF	400V	Poly.	**3p**
0·001µF	500V	S/M	**10p**
0·001µF	500V	Cer.	**5p**
0·001µF	1,000V	MDC	**6p**
0·0015µF	400V	Poly.	**3p**
0·0015µF	500V	S/M	**10p**
0·0015µF	500V	Cer.	**5p**
0·0018µF	500V	S/M	**10p**
0·002µF	100V	Mylar	**3p**
0·002µF	500V	Cer.	**5p**
0·0022µF	125V	P.S.	**6p**
0·0022µF	500V	S/M	**10p**
0·0022µF	1,000V	MDC	**6p**
0·0027µF	500V	S/M	**15p**
0·003µF	500V	Cer.	**5p**
0·0033µF	125V	P.S.	**6p**
0·0033µF	500V	Poly.	**6p**
0·0033µF	1,000V	MDC	**6p**
0·0036µF	500V	S/M	**15p**
0·0047µF	125V	P.S.	**9p**
0·0047µF	500V	Poly.	**6p**
0·0047µF	500V	S/M	**20p**
0·0047µF	1,000V	MDC	**6p**
0·005µF	100V	Mylar	**3p**
0·005µF	500V	Cer.	**5p**
0·0068µF	125V	P.S.	**10½p**
0·0068µF	500V	S/M	**30p**
0·0068µF	500V	Poly.	**6p**
0·0082µF	125V	P.S.	**10½p**
0·0082µF	500V	S/M	**30p**
0·01µF	18V	Disc	**4p**
0·01µF	125V	P.S.	**10½p**
0·01µF	160V	Poly.	**4p**
0·01µF	250V	M.F.	**3p**
0·01µF	400V	Poly.	**3p**
0·01µF	500V	Cer.	**5p**
0·01µF	500V	S/M	**30p**
0·01µF	600V	MDC	**7p**
0·01µF	1,000V	MDC	**9p**
0·015µF	160V	Poly.	**3p**
0·015µF	400V	Poly.	**3p**
0·02µF	100V	Mylar	**3p**
0·022µF	18V	Disc	**5p**
0·022µF	250V	M.F.	**3p**
0·022µF	400V	Poly.	**3p**
0·022µF	600V	MDC	**7½p**
0·022µF	1,000V	MDC	**9p**
0·033µF	250V	M.F.	**4p**
0·033µF	400V	Poly.	**4p**
0·047µF	12V	Disc	**6p**
0·047µF	160V	Poly.	**3p**
0·047µF	250V	M.F.	**3p**
0·047µF	400V	Poly.	**4p**
0·047µF	600V	MDC	**8p**
0·047µF	1,000V	MDC	**10p**
0·1µF	30V	Disc	**6p**
0·1µF	250V	M.F.	**4p**
0·1µF	400V	Poly.	**5p**
0·1µF	600V	MDC	**10p**
0·1µF	1,000V	MDC	**13p**
0·15µF	250V	M.F.	**5p**
0·22µF	160V	Poly.	**6p**
0·22µF	250V	M.F.	**5p**
0·22µF	400V	Foil	**10p**
0·22µF	1,000V	MDC	**15p**
0·33µF	250V	M.F.	**8p**
0·47µF	250V	M.F.	**8p**
0·47µF	400V	Foil	**15p**
0·47µF	1,000V	MDC	**20p**
1·0µF	250V	M.F.	**15p**

Note:
S/M = silver mica 1% tol.
P.S. = polystyrene 2½% tol.
MDC—a.c. rating = 300V.
M.F. = Mullard min. foil.
Cer. = ceramic.

MAIL ORDERS: Some items have a post and packing charge shown against them. Where p. & p. is not shown the charge is 12p for any selection. When both classes of goods are ordered the charge is 12p plus any p. & p. charges shown. (Overseas extra.) Telephone 01-692 4412

If we can land moon modules we can certainly land you a good job

We are Control Data Corporation, a major American computer manufacturer, providing, among other things, computers that help control the landing of Apollo moon modules. Because computers have become the world's fastest expanding industry we want to meet men and women interested in training under us for really good jobs with our customers and with other computer users. By 1980, it is predicted, computers will form the world's largest industry and 90% of trainees are currently placed in jobs almost immediately. No specific qualifications are required for training – simply a clear, logical mind.

Telephone

01-637 2171

between 9 a.m. and 9 p.m. from Monday to Friday
and ask for Peter East

CONTROL DATA INSTITUTE
77-79 Wells Street, Oxford Street, London. W.1.

CONTROL DATA
LIMITED

MICROJET WELDER

A TINY FLAME UP TO 5,000°F! WELDS·BRAZES SOLDERS

INC.3 FLAME TIPS £11.50

A precision tool using a combination of butane and compressed oxygen. U.S.A. manufactured. Gives two sizes of flame **of pencil lead thickness. Adjustable temperatures up to 5,000°F.** Lights instantly, no priming. Cuts metals, welds, brazes and solders, etc., gold and silver. Ideal for electronics and electrical engineering, jewellers, clockmakers, silversmiths. Up to 40 minutes operation using fuel supplied. Replacement set of 2 oxygen and 1 butane cylinders **£1·50** inc. post. Complete with instructions. Our price **£11·50**+ 31p P. & P. Send **£11·81.**

13 AMP DISTRIBUTION PANEL

From Only £2·40

Safe and quick. FOUR 13 amp 3-pin shuttered Socket Outlets Red neon warning indicator operates when in use. **Only £2·40** + 35p P. & P. **Total £2·75.** Also **De Luxe Model** (illus.) **PLUS** On/Off switch **PLUS** Magnetic Contact Breaker **—If you draw too much current it switches off automatically. PLUS 30ft** (9 metres) approx. lead. **£7·25** + 40p P. & P. **Total £7·65. Bonus offer:** if required, set of **four fused 13 amp plugs 50p** extra. **Post free if ordered with above.**

TWIST FREE STORAGE
WITH THE 'SAFE-WAY' MAINS EXTENSION LEAD

SUITABLE FOR ALL DOMESTIC APPLIANCES & POWER TOOLS

INTRODUCTORY PRICE ONLY

£1·69

Store cable tidily. Heavy duty 3-core cable fitted unbreakable rubber standard 13 amp fused 3-pin plug and 3-pin socket. Saves trouble fitting yourself. Ideal for Domestic Appliances. Garden Power Tools, Hedge Trimmers, Mowers, etc. **30ft.** app cable and **FREE** storage reel **£1·69** + 41p P. & P. Send **£2·10. 15ft.** app. **£1·20** + 35p P. & P. **50ft.** app. **£2·20** + 41p P. & P. **75ft.** app **£3** + 50p P. & P. **100ft.** app **£3·75** + 55p P. & P. **50ft.** app. **"Roverpoint"** cable **with winder reel,** socket, plug, carry handle **£3·99** + 35p P. & P.

BINOCULAR MAGNIFIER

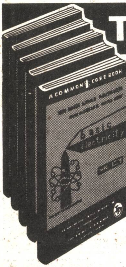
FOR PRECISION CLOSE-UP WORK-LEAVES BOTH HANDS FREE

ONLY £5·25

See close-up work with less eye strain and fatigue. Lightweight adjustable headband. **Powerful optically ground lenses** from Continental glassworks. Can be worn over normal glasses. An essential aid in modelling, industry, home and workshop. Stamp collecting Jewellers, watchmakers and any fine work. 2½× magnification. **£5·25** + 35p P. & P. **Send £5·60.** 3× model **50p** extra. State model.

TWIN-BEAM SPEC-LAMP — Worn just like a pair of spectacles. Two powerful spot lamps illuminate working area. **Can be worn with Binocular Magnifier.** Battery operated. **Only £1·90** + 10p. P. & P. **Send £2.**

JOHN DUDLEY & CO. LTD.
Childs Hill, London, N.W.2.
Dept. EE2, 301 Cricklewood Lane,
Tel. 01-458 5917 **Callers welcome.**



The Pictorial Method

BASIC ELECTRICITY (5vols)
ELECTRONICS (6vols)
TELEVISION (3vols)

You'll find it easy to learn with this outstandingly successful PICTORIAL METHOD. The essential facts are explained in the simplest language, one at a time, and each is illustrated by an accurate cartoon-type drawing. These clear and concise illustrations make study a real pleasure. The books are based on the latest research into simplified learning techniques. This easy-approach-to-learning method has proved beyond doubt that acquiring knowledge can be an enjoyable experience.

YOUR 100% GUARANTEE

Should you be, in any way dissatisfied with the MANUALS your money will be refunded by return of post.

The series will be of exceptional value in training mechanics and technicians in Electricity, Radio and Electronics.

WHAT READERS SAY

You have my firmest recommendation in favour of this method of Self Teaching.
B.W. Blackburn.

The best I have ever had: they are fantastic and everything your readers say.
P.L.W. Davenport.

I have made great use of the Basic Manuals.
B.C. Hendon.

I have found the Electronics volumes so interesting: please rush me Electricity.
C.A. Folkestone.

POST NOW FOR THIS OFFER!

To The SELRAY BOOK CO., 60 HAYES HILL, HAYES, BROMLEY, KENT. BR2 7HP

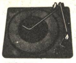
Please find enclosed P.O./Cheque value £...........
BASIC ELECTRICITY 5 parts £4·50 ☐
BASIC ELECTRONICS 6 parts £5·40 ☐
BASIC TELEVISION 3 parts £3·60 ☐
Tick Set(s) required. Prices include Postage and Packing.

YOUR 100% GUARANTEE. If after 10 days examination you decide to return the Manuals your money will be refunded in full.

NAME ....
BLOCK LETTERS
FULL POSTAL..
ADDRESS ....
....

BSR LATEST SUPERSLIM

STEREO AND MONO



Plays 12", 10" or 7" records, Auto or Manual. A high quality unit backed by BSR reliability with 12 months' guarantee. AC 200/250v. Size 13⅛ × 11¼in. Above motor board 3⅜in. below motor board 2⅛in.

with STEREO and MONO XTAL **£8·75** Post 25p.

MONO-COMPATIBLE Plays all records **£7·75** Post 25p.

RCS DE-LUXE 3 WATT AMPLIFIER. Ready made tested. Printed circuit. 3 watts output. Tone and volume controls. Complete with two knobs, output valve and rectifier and high performance loudspeaker. Double wound fully isolated mains transformer. AC Mains 200/250v. Response 50-12,000 cps. Sensitivity 300mV. **£4** Post 25p.

GARRARD DISCO DECK

£10 POST FREE

4 speeds. Plays all sizes of records. 4 pole heavy duty motor. 9in. steel turntable. Plug in head complete with stereo/mono cartridge. Adjustable stylus pressure. Autostop. Brown and Cream finish. AC mains 110/240v. Base plate size 12in. × 8in. Operating area 14in. × 12¼in, Above motor board 3in., below motor board 2⅜in. Ideal for Home Hi-Fi or Discotheque.

GARRARD AUTOCHANGERS with Sonotone Cartridges Stereo Diamond and Mono Sapphire. Model 1025 £10. Model 3500 Stereo and Mono Autochanger £14. Post 25p.

BSR JUNIOR SINGLE PLAYER Turntable, 4-speed motor and separate pick-up **£4·50**

HI-FI PICK-UP CARTRIDGES. Diamond LP/Stereo Stereo/Mono 9TA £2·50; GP94 £2·50; GP93 £2·00; Sapphire Mono GP91 £1·50; Power-point LP/78. 60p.

E.M.I. WOOFER AND TWEETER KIT

£5·75 Post 25p

Comprising a fine example of a Woofer 10¾ × 6½in. with a massive Ceramic Magnet, 44oz, Gauss 13,000 lines. Aluminium Cone centre to improve middle and top response. Also the E.M.I. Tweeter 3½in. square has a special lightweight paper cone and magnet flux 10,000 lines. Crossover condenser included.

Impedance Standard .... 8 ohms
Maximum Power .... 12 watts
Useful Response .... 35 to 18,000 cps
Base Resonance .... 45 cps

SUITABLE ENCLOSURE 20 x 13 x 9in, £9 POST 25p
MODERN TEAK DESIGN

WEYRAD P50—TRANSISTOR COILS

RA2W Ferrite Aerial	72p	Spare Cores	3p
Osc. P50/1AC	33p	Driver Trans. LFDT4	58p
I.F. P50/2CC 470 kc/s	36p	Printed Circuit, PCA1	58p
3rd I.F. P50/3CC	36p	J.B. Tuning Gang	65p
P51/1 or P51/2	36p	Weyrad Booklet	10p
P50/3V	36p	OPTI	58p

Mullard Ferrite Rod 8 × ⅜in. 20p, 6 × ⅜in. 20p.

VOLUME CONTROLS

Long spindles. Midget Size 5 K. ohms to 2 Meg. LOG or LIN. L/S 15p. D.P. 25p. STEREO L/S 55p. D.P. 75p. Edge 5K. S.P. Transistor 25p

80 Ohm Coax 4p. yd.

BRITISH AERIALITE AERAXIAL-AIR SPACED 40 yd. £1·40; 60 yd. £2

FRINGE LOW LOSS Ideal 625 and colour. **10p yd.**

8in & 10in ELAC

HI-FI SPEAKERS

Dual cone plasticised roll surround. Large ceramic magnet. 50-16,000 cps Bass resonance 55 cps 8 ohm coil 8in. 10 watt 10in. 12 watt music power. **£3·75**

E.M.I. 13½ × 8in. SPEAKER SALE!

With twin tweeters and crossover, 10 watt State 3 or 8 or 15 ohm. (As illustrated) **£4·25** Post 25p

With flared tweeter cone and ceramic magnet, 10 watts. Bass res. 45-60 cps. Flux 10,000 gauss. State 3 or 8 or 15 ohm. **£2·25** Post 25p

TEAK CABINET 16 × 10 × 9in Fluted Front **£5** Post 25p

BLANK ALUMINIUM CHASSIS 18 s.w.g. 2in. sides. 7 × 4in. 45p; 9 × 7in. 60p; 11 × 7in. 70p; 13 × 9in. 90p; 14 × 11in. 95p; 15 × 14in. 99p; 11 × 3in. 50p; 16 × 10in. £1.

ALUMINIMUM PANELS 18 s.w.g. 6 × 4in. 9p; 8 × 6in. 15p; 14 × 3in. 16p; 10 × 7in. 19p; 12 × 5in. 20p; 12 × 8in. 28p; 16 × 6in. 28p; 14 × 9in. 34p; 12 × 12in. 40p; 16 × 10in. 50p

R.C.S. STABILISED POWER PACK KITS

All parts and instructions with Zener Diode, Printed Circuit, Bridge Rectifiers and Double Wound Mains Transformer input 200/240v. AC. Output voltages available 6 or 9 or 12 or 15 or 18 or 20v. DC at 100mA or less. PLEASE STATE VOLTAGE REQUIRED. Details S.A.E. Size 3½ × 1½ × 1⅝in. **£2** POST FREE

GENERAL PURPOSE TRANSISTOR PRE-AMPLIFIER BRITISH MADE

Ideal for Mike, Tape, P.U., Guitar. Can be used with Battery 9–12v. or H.T. line 200–300v. D.C. operation. Size 1¾" × 1¼" × ¾". Response 25 c.p.s. to 25 Kc/s. 26db gain. For use with valve or transistor equipment. Full instructions supplied. Details S.A.E. **90p** Post 10p

NEW TUBULAR ELECTROLYTICS				CAN TYPES	
2/350V	14p	250/25V	14p	50+50/350V	35p
4/350V	14p	500/25V	20p	60+100/350V	58p
8/450V	14p	100/25V	35p	32+32/250V	18p
16/450V	15p	100/50V	47p	32+32/450V	33p
32/450V	20p	8+8/450V	18p	350+50/325V	50p
25/25V	10p	8+16/450V	20p	32+32+32/350V	43p
50/50V	10p	16+16/450V	25p	100+50+50/350V	48p
100/25V	10p	32+32/350V	25p		

LOW VOLTAGE ELECTROLYTICS
1, 2, 4, 5, 8, 16, 25, 30, 50, 100, 200mF. 15V. 10p
500mF. 12V. 15p; 25V. 20p; 50V. 30p.
1000mF. 12V. 17p; 25V. 35p; 50V. 47p; 100V. 70p.
2000mF. 6V. 25p; 25V. 42p; 50V. 57p.
2500mF. 50V. 62p; 3000mF. 25V. 47p; 50V. 65p.
5000mF. 6V. 25p; 12V. 42p; 25V. 75p; 35V. 85p; 50V. 95p

CERAMIC 1pF to 0·01mF, 4p. Silver Mica 2 to 5000pF. 4p.

PAPER 350V-0·1 4p, 0·5 13p; 1mF 15p; 2mF 150V 15p. 500V-0·001 to 0·05 4p; 0·1 5p; 0·25 8p; 0·47 25p.

SILVER MICA. Close tolerance 1% 2·2-500pF 8p; 500-2·200 pF 10p; 2,700-5,600pF 20p; 6,800pF-0·01, mfd 30p; each.

TWIN GANG. "0-0" 208pF+176pF, 65p; Slow motion drive 365+365 with 25+25pF, 50p; 500pF slow motion, standard 45p; small 3-gang 500pF £1·60.

SHORT WAVE, SINGLE. 10pF 30p; 25pF 55p; 50pF 55p.

NEON PANEL INDICATORS 250V AC/DC Amber 20p.

RESISTORS, ¼ w., ½ w., 20% 1p; 2 w. 5p 10 ohms to 10 meg

HIGH STABILITY. ½ w. 2%, 10 ohms to 1 meg., 10p. Ditto 5% Preferred values 10 ohms to 10 meg., 4p.

WIRE-WOUND RESISTORS 5 watt, 10 watt, 15 watt 10 ohms to 100K, 10p each; 2½ watt, 1 ohm to 8·2 ohms 10p.

GARRARD DECCADEC SP25 MKII RECORD PLAYER

With Stereo/Mono Deram Cartridge transcription head and arm Four speeds. 10½in. turntable. Anti-rumble filter Bias compensation. Laboratory motor.

SPECIAL PRICE £18·50 Post 25p

METAL PLINTH & PLASTIC COVER

Cut out for most Garrard or B.S.R. Will play with cover in position. Latest design. Covered in black leatherette. Antimagnetic. 12½ x 14¼ x 7½in. **£4·50** POST 35p

ALSO AVAILABLE IN SOLID NATURAL MAHOGANY WAX POLISHED FINISH AT SAME PRICE

MAINS TRANSFORMERS

ALL POST 25p each

250-0-250 80 mA. 6·3v. 4 amp	£1·50
250-0-250 80 mA. 6·3v. 3·5a. 6·3v. 1a or 5v. 2a.	£2·50
350-0-350 80 mA. 6·3v. 3·5a. 6·3v. 1a. or 5v. 2a.	£3·00
300-0-300v. 120mA., 6·3v. 4a. C.T.; 6·3v. 2a	£3·25
MINIATURE 200v. 200mA., 6·3v. 1a. 2½ × 2½ × 2in.	75p
MIDGET 220v. 45 mA., 6·3v. 2a. 2¾ × 2½ × 2in.	90p
MINI-MAINS 20v, 100mA. 1⅜ × 1⅜ × 1⅜in.	50p
HEATER TRANS. 6·3v. 3 a.	60p
Ditto tapped sec. 1·4 v., 2, 3, 4, 5, 6·3 v. 1½ amp	95p

GENERAL PURPOSE LOW VOLTAGE. Tapped Outputs at 2 amp. 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 24 and 30 v. £2·25
1 amp., 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60, £2·25
2 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60. £3·25
5 amp. 6, 8, 10, 12, 16, 18, 20, 24, 30, 36, 40, 48, 60. £8·75

AUTO TRANSFORMERS 115v. to 230v. or 230v. to 115v. 150w. £2·25; 500w. £6·25; 750w. £10; 100w. £14.

CHARGER TRANSFORMERS. Input 200/250v. for 6 or 12v., 1½ amp., £1·50; 2 amp £1·80; 4 amp. £2·50.

FULL WAVE BRIDGE CHARGER RECTIFIERS: 6 or 12v. outputs, 1½ amp. 40p; 2 amp. 55p; 4 amp. 85p

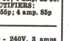
LUCAS 2DS500 Bridge 70V 5 amp £1.

MAINS ISOLATING TRANSFORMER
Primary 0 - 110 - 240V. Secondary 0 - 240V. 3 amps. 720 watts. Insulated terminals. Varnish impregnated. Fully enclosed in steel case with fixing feet. Famous make. BARGAIN OFFER £10, Carriage 50p.

1¼ inch **DIAMETER WAVE-CHANGE SWITCHES** 25p. 2 p. 2-way, or 2 p. 6-way or 3 p. 4-way 25p each. 1 p. 12-way. or 4 p. 2-way, or 4 p. 3-way 25p.

TOGGLE SWITCHES, sp. 14p; dp. 18p; dp. dt. 23p.

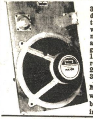
"THE INSTANT" BULK TAPE ERASER & HEAD DEMAGNETISER



200/250v. A.C. Leaflet S.A.E. **£2·35** Post 15p

ALL MODELS "BAKER SPEAKERS" IN STOCK
Hi-Fi Enclosure Manual containing 20 plans, crossover data and cubic tables. 42p Post Free.

BAKER 12in. MAJOR £9



30-14,500 c.p.s., 12in. double cone, woofer and tweeter cone together with a BAKER ceramic magnet assembly having a flux density of 14,000 gauss and a total flux of 145,000 Maxwells. Bass resonance 40 c.p.s. Rated 20 watts. Voice coils 3 or 8 or 15 ohms. Post Free

Module kit, 30-17,000 c.p.s. with tweeter, crossover, baffle and instructions. **£11·50**

BAKER "BIG—SOUND" SPEAKERS

'Group 25'	'Group 35'	'Group 50'
12 inch 25 watt 3 or 8 or 15 ohm **£8**	12 inch 35 watt 3 or 8 or 15 ohm **£9**	15 inch 50 watt 8 or 15 ohm **£20**

TEAK HI-FI SPEAKER CABINETS. Fluted wood front
For 12in. or 10in. dia. speaker 20 × 13 × 9in. £9. Post 25p
For 13 × 8in. or 8in. speaker 16 × 10 × 9in. £5. Post 25p
For 10 × 6in. or 6in. speaker 16 × 8 × 6in. £4. Post 25p
LOUDSPEAKER CABINET WADDING 18in. wide, 15p ft

GOODMANS 6½ in. HI-FI WOOFER

8 ohm, 10 watt. Large ceramic magnet. Special Cambric cone surround. Frequency response 30–12,000 cps. Ideal P.A. Columns. Hi-Fi Enclosures Systems, etc. **£4**

ELAC CONE TWEETER

The moving coil diaphragm gives a good radiation pattern to the higher frequencies and a smooth extension of total response from 1,000 cps to 18,000 cps. Size 3½ × 3½ × 2in. deep. Rating 10 watts. 3 ohm or 15 ohm models. **£1·90** Post 10p

SPEAKER COVERING MATERIALS. Samples Large S.A.E.

Horn Tweeters 2-16kc/s, 10W 8 ohm or 15 ohm £1·50.

De Luxe Horn Tweeters 2-18 Kc/s, 15W, 15 ohm £3.

TWO-WAY 3000cps CROSSOVERS 3 or 8 or 15 ohm 95p.

SPECIAL OFFER! 80 ohm 2¼in.; 2⅜in.; 35 ohm, 2in.; 3in. 25 ohm, 2⅝in. dia.; 3in. dia.; 6 × 4in.; 8 × 5in. 15 ohm. 3⅝in. dia.; 6 × 4in.; 7 × 4in.; 3 ohm. 2⅜in. 3in., 5in. dia. **£1** EACH TYPE

LOUDSPEAKERS P.M. 3 OHMS. 7 × 4in. £1·25; 6½in. £1·50; 8 × 5in. £1·60; 8 × 2⅝in. 90p 8 in. £1·75; 10 × 6in. £1 90.

RICHARD ALLAN TWIN CONE LOUDSPEAKERS. 8in. dia. 4 watt; 10in. dia. 5 watt; 12in. dia. 6 watt 3 or 8 or 15 ohm models £2·20 each. Post 15p.

VALVE OUTPUT TRANS. 25p; **MIKE TRANS.** 50:1 25p. **5 WATT MULTI-RATIO,** 3, 8 and 15 ohms 80p.

BAKER 100 WATT ALL PURPOSE TRANSISTOR AMPLIFIER

4 Inputs speech and music. Mixing facilities. Response 10–30,000 cps. Matches all loudspeakers. A.C. 200/250V. Separate Treble and Bass Controls. Guaranteed. Details S.A.E. **£49** Post Free

BARGAIN AM TUNER. Medium Wave. Transistor Superhet. Ferrite aerial. 9 volt. **£4·50**

BARGAIN 4 CHANNEL TRANSISTOR MONO MIXER Add musical highlights and sound effects to recordings. Will mix Microphone, records, tape and tuner with separate controls into single output. 9 volt. **£3·50**
STEREO VERSION OF ABOVE £4·50

BARGAIN FM TUNER 88-108 Mc/s Six Transistor. 9 volt Printed Circuit. Calibrated slide dial tuning. Walnut Cabinet. Size 7 × 5 × 4inch **£12·50**

BARGAIN FM TUNER as above less cabinet **£8·85**

BARGAIN 3 WATT AMPLIFIER. 4 Transistor Push-Pull Ready built, with volume control. 9v. **£3·50**

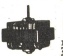
COAXIAL PLUG 6p. **PANEL SOCKETS** 6p. **LINE** 18p **OUTLET BOXES, SURFACE OR PLUSH** 25p.

BALANCED TWIN RIBBON FEEDER 300 ohms, 5p yard.

JACK SOCKET Std. open-circuit 14p, closed circuit 23p; Chrome Lead Socket 45p. Phono Plugs 5p. Phono Socket 5p.

JACK PLUGS Std. Chrome 15p: 3·5mm Chrome 14p. **DIN SOCKETS** Chassis 3-pin 10p; 5-pin 10p. **DIN SOCKETS** Lead 3-pin 18p; 5-pin 25p. **DIN PLUGS** 3-pin 18p; 5-pin 25p.

VALVE HOLDERS, 5p; **CERAMIC** 8p; **CANS** 5p.



E.M.I. TAPE MOTORS Post 15p.
120v. or 240v. AC. 1,200 r.p.m. 4 pole 135mA. Spindle 0·187 × 0·75in Size 3¼ × 2½ × 2¼in. (illustrated) **£1·25**

E.M.I. GRAM MOTORS
120v. or 240v. A.C. 1,200 r.p.m. 2 pole 70mA. Spindle ⅛ × 3/16in. Size 2⅞ × 2½ × 2⅜in. Post 15p **75p**

HI-FI STOCKISTS RETURN OF POST DESPATCH MINIMUM POST AND PACKING 15p CUSTOMERS FREE CAR PARK CALLERS WELCOME

RADIO COMPONENT SPECIALISTS

337 WHITEHORSE ROAD, CROYDON
Open 9—6 p.m. (Wednesdays 9—1 p.m., Saturdays 9—5 p.m.)

Radio Books & Component Lists 5p. Written guarantee. (Export: Remit cash and extra postage.) Buses 50, 68, 159 Rail Selhurst. Tel. 01-684-1665

Everyday Electronics Classified Advertisements

RATES: 9p per word (minimum 12 words). Box No. 10p. extra. Semi-display—£6·00 per single column inch. Advertisements must be prepaid and addressed to Classified Advertisements Department, "EVERYDAY ELECTRONICS," I.P.C. Magazines Ltd., Fleetway House, Farringdon Street, London EC4A 4AD.

RECEIVERS and COMPONENTS

MINI MAINS PACK KIT. Safe double wound mini transformer, silicon rects., 1,000μF smoothing. Delivers 9V d.c., 120 mA. Components with data sheet; pack buildable to size of PP6, etc., battery. £0·90+U.K. post 5p. By mail only from AMATRONIX LTD., 396 Selsdon Road, South Croydon, Surrey, CR2 0DE.

SOUND SUPPLIES
(Electronics) Co. Ltd.

P.A. EQUIPMENT. Marshall amps. instruments and guitars, etc. TOA and Eagle amps and accessories. Reslo mics, etc.
COMPONENTS. Resistors, capacitors, plugs, sockets, cables, audio leads, semiconductors, valves, vero board, etc., for the constructor.
Power packs and car droppers for the cassette recorder or radio.
S.A.E. for list and enquiries. P.A. list 15p.

12 Smarts Lane, Loughton, Essex
Tel. 01-508 2715 Closed all day Thursday

UNUSED COMPONENTS. Excellent variety. £1 per hundred. Postal only. Chaplin, 5 Brewhouse Hill, Wheathampstead, Herts.

NEW MODEL V.H.F. KIT Mk 2

Our latest kit. Improved design and performance plus extra amplifier stage, receives aircraft, amateurs, mobile, radio 2, 3, 4, etc., this novel little set will give you endless hours of pleasure and can be built in one evening. Powered by 9 volt battery, complete with easy to follow instruction and built in jack socket for use with earphones or amplifier.

Only **£3·50** + p. & p. 10p U.K. only.

Illustrated catalogue of selected kits and components. 15p P. & P. free.

Galleon Trading Co., Dept E.E.
12 Burrs Way,
Corringham,
Stanford-le-Hope, Essex.

HEADPHONES: Matching 9R59DS, EC10 and all low impedance receivers. Luxury lightweight adjustable, foam padded. Japanese: £2·60. Partridge Electronics Ltd., Broadstairs, Kent.

EXPRESS COMPONENTS

17 Albert Square, Stratford,
London E15 1HJ

ELECTRONIC KITS FOR
E.E. PROJECTS

HAVE you waited weeks (or months) in the past for your electronic components to arrive??? Well you won't have to any more—not if you order from us!!! It is our intention to satisfy our customers—quickly and completely!!! This month's bargains are:—

HORSES FOR COURSES	**£2·00**
WASH/WIPE CONTROLLER	**£2·10**
SIGNAL INJECTOR	**£0·75**
ELECTRONOME	**£1·65**
SHAVER INVERTER (20 watt)	**£3·75**
INFRARED BURGLAR ALARM	**£3·30**

These kits comprise all electronic components to complete the project.

OTHER COMPONENTS Transistors: AD142 (similar characteristics to OC26, OC28, OC29 OC35)..**35p** each; **Relays:** 185 Ω 2-pole change over 5A contacts..**£1·00** each; **Wafer switches:** 1-pole 12-way, 4-pole 3-way, 3-pole 4-way..**20p** each; **Microswitch:** S.P.C.O...**15p** each; **Potentiometers:** 25kΩ log..**12p** each, 250kΩ log with D.P.D.T. switch..**20p** each; **Mains neons** (with resistor)..**20p** each.

Orders over 50p post free, others add 5p.

MAIL ORDER ONLY

FOR ALL YOUR Electronic Component requirements. Send for free list to B.C. Electronic Supplies, 7 Regent Road, Huddersfield HD1 4NR.

COMPUTER PANELS 5BC108, diodes, 4-50p post 10p. PANELS WITH SILICON AND GERM/TRANS. at least 50. 6—**£1·00** post 15p. UNIT WITH 4-LA2 POT CORES CAPS **50p** post 15p. ICs 7400 SERIES ON PANEL(S) 10—**75p** post 10p. FALLOUTS 5—**13p.** ORP12 on panel ex equipt. **35p** cp. WIRE ENDED NEONS 10—**45p, 20—75p** post 8p. SEND LARGE S.A.E. FOR LIST OF PANELS ETC.
7LB ASSORTED COMPONENTS **£1·30 cp.**

J.W.B. RADIO
75 HAYFIELD ROAD SALFORD 6 LANCS
MAIL ORDER ONLY

Versatile

10 in ONE

MINI-LAB *Comprising*

● AC & DC Voltmeter ● Audio Generator ● Ohm Meter ● Resistance Substitution ● Capacitance Substitution ● DC Ammeter ● Battery Supply ● RF Signal Generator ● RF Field Strength Indicator

This new, unique instrument combines all you need for testing. Guaranteed, money back if not satisfied.

£11.25
+25p. p&p

Cash with order or write for illustrated data sheet to:

RSL COMPONENTS (Dept. EE)
Cricketfield Lane, Bishop's Stortford, Herts.

MISCELLANEOUS

MUSICAL MIRACLES

KITS to build quality accessories:—

WAA-WAA all parts, electronic & mech. **£2·95**
FUZZORAMA quality fuzz box **£4·75** P&P 20p.
BASS PEDAL 16′ and 8′ tones **£35**

BUILD A SYNTHESISER OR AUTO RHYTHM from **Dewtron** professional modules

Cat. **15p** from **D.E.W. Ltd., 254 Ringwood Road, Ferndown, Dorset BH22 9AR**

NO NEED TO WORRY ABOUT A TRANSMITTING LICENCE

because this GPO approved transmitter/receiver kit does not use R.F. and you can get one easily. Your transmissions will be virtually SECRET since they won't be heard by conventional means. Actually it's TWO KITS IN ONE because you get the printed-circuit boards and components for both the transmitter AND receiver. You're going to find this project REALLY FUN-TO-BUILD with the EASY-TO-FOLLOW instructions. An extremely flexible design with quite an AMAZING RANGE—has obvious applications for SCHOOL PROJECTS, LANGUAGE, LABORATORIES, SCOUT CAMPS, etc.

GET YOURS! SEND £5·50 NOW
S.A.E. for details

TO: **BOFFIN PROJECTS,**
DEPT. KEE.
4 CUNLIFFE ROAD,
STONELEIGH, EWELL, SURREY

EDUCATIONAL

MEN! You can earn £50 p.w. Learn computer operating. Send for FREE brochure—London Computer Operators Training Centre, G22 Oxford House, 9-15 Oxford Street, London, W.1.

FREE

TO ENGINEERS

Whatever your age or experience you must read New **Opportunities.** It describes the easiest way to pass **A.M.S.E., A.M.I.M.I., City & Guilds (all branches), Gen. Cert.,** etc., and gives details of courses in all branches of engineering **Mechanics, Electrical, Civil, Auto, Aero, Radio, TV, Building, etc.** You must read this book.

Send for your copy today—FREE!
B.I.E.T. B32, Aldermaston Court,
Reading, RG7 4PF
Accredited by the Council for the Accreditation of Correspondence Colleges

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

YOU CAN BE AN
ELECTRONICS EXPERT

With I.C.S. home study. Pass exams *in your spare time* and join the highly paid specialists of the electronics industry. Electronics, Electrical Engineering, C & G Certificates and many specialised courses. Send for FREE details stating subject of interest.

ICS School of Electronics and Electrical Engineering, Dept. 566N, Intertext House, Stewarts Road, London SW8 4UJ.

SANWA MULTI TESTERS

P2B	2,000 Ω/V	**£4·85**
JP-5D	2,000 Ω/V	**£5·80**
U50-DX	20,000 Ω/V	**£8·35**
360 YTR	10,000 Ω/V	**£7·95**
A303 TRD	20,000 Ω/V	**£10·35**
N401	200,000 Ω/V	**£32·85**

MAGNETIC CARTRIDGES

Goldring		Shure	
G800	**£6·95**	M44-7	**£6·95**
G800H	**£6·55**	M55-E	**£8·85**
G800E	**£11·55**	M75–6 Slim	**£8·85**
G800 Super E	**£18·25**	M75–EJ(2)	**£12·70**
G850	**£4·95**	M75–E(2)	**£13·75**

TRANSISTORS

AC107	**28p**	AD161	**75p pr**
AC126	**27p**	AD162	
AC127	**23p**	BC107	**12p**
AC132	**19p**	BC108	**12p**
AD149	**47p**	BC109	**12p**
BC147	**20p**	OC71	**14p**
BD112	**44p**	OC81D	**19p**
BFY51	**23p**	OCP71	**45p**
OC26	**40p**	2N2926	**13p**
OC28	**52p**	2N3055	**65p**

RECORDING TAPE

S.P. 5in	600ft	**50p**	R.S. COMPO-
L.P. 5in	900ft	**65p**	NENTS,
D.P.5in	1200ft	**92p**	TUNERS,
S.P. 5¾in	900ft	**65p**	AMPLIFIERS,
L.P. 5¾in	1200ft	**83p**	DISCO,
D.P. ¾in	1800ft	**£1·18**	VERO
S.P. 5in	1200ft	**78p**	BOARD
L.P. 77in	1800ft	**98p**	S.A.E. for
D.P. 7in	2400ft	**£1·44**	FREE leaflets

CATALOGUE 25p POST FREE. All prices POST FREE. Minimum order 50p. MAIL ORDER ONLY FROM

CELECTRON-E
P.O. BOX No. 1, LLANTWIT MAJOR, GLAMORGAN CF6 9YN

FOR SALE

SURPLUS STOCK AT REDUCED PRICES

Cs — Rs — Transistors — small 3v Electric Motors—Relays—Transformers—Plugs—Sockets—Etc., Etc.

Send S.A.E. for list.

W.E.C. LTD
HIGH STREET, RIPLEY, SURREY

TRANSISTORS

TRANSISTORS 2p EACH

SPECIAL BULK PURCHASE

New unmarked, assorted gain transistors. NPN-PNP similar to: BFY 50-53, BCY 30-33, BFX.88, 2N3702-3, 2N.3704-11, 2N.706. In packs of 50 (units of 10) state types required.

PRICE £1 PER PACK
CWO—add 10p P. & P.
Send 3p for Stock and Price Lists
DIODE IN914 (IN4148) at 3p each
BACON ELECTRONICS
133 High St., **HURSTPIERPOINT**, Sussex
TEL. 2554-5

SERVICE SHEETS

SERVICE SHEETS for Televisions, Radios, Transistors, Tape Recorders, Record Players, etc., from 5p with free Fault-Finding Guide, S.A.E. orders/enquiries. Catalogue 15p. Hamilton Radio, 47 Bohemia Road, St. Leonards, Sussex. Telephone Hastings 29066.

BOOKS

"HOW TO LISTEN TO THE WORLD," published October 1972, £1·90, post 10p direct from World Publications' Warehouse, order from: David McGarva, Box 114E, Edinburgh EH1 1HP.

CASSETTES

TOP QUALITY, low noise audio magnetics cassettes with fitted screws, in library case, C60 30p, C90 40p, C120 50p. P&P 15p. Ingo Ltd., 72 West End Lane, London, NW6.

WANTED

EVERYDAY ELECTRONICS, parts 1, 3, 4, 5, 7. State price required. Box 2.

URGENTLY REQUIRED, the first eight parts of Everyday Electronics complete, please reply immediately. Box No. 3.

YATES ELECTRONICS
(FLITWICK) LTD

DEPT. E.E., ELSTOW STORAGE DEPT.
KEMPSTON HARDWICK,
BEDFORD.

C.W.O. PLEASE. POST AND PACKING PLEASE ADD 10p TO ORDERS UNDER £2

Catalogue which contains data sheets for most of the components listed will be sent free on request. 10p stamp appreciated.

OPEN ALL DAY SATURDAYS

RESISTORS

½W Iskra high stability carbon film—very low noise—capless construction. ½W Mullard CR25 carbon film—very small body size 7·5 x 2·5mm. ½W 2% Electrosil TR5.

Power watts	Tolerance	Range	Values available	Price 1–99	Price 100+
½	5%	4·7Ω–2·2MΩ	E24	**1·0p**	**0·8p**
½	10%	3·3MΩ–10MΩ	E12	**1·0p**	**0·8p**
½	2%	10Ω–1M	E24	**3·5p**	**3·0p**
⅛	10%	1Ω–3·9Ω	E12	**1·0p**	**0·8p**
⅛	5%	4·7Ω–1MΩ	E12	**1·0p**	**0·8p**
4	10%	1Ω–10Ω	E12	**6p**	**5·5p**

Quantity price applies for any selection. Ignore fractions on total order.

DEVELOPMENT PACK

0·5 watt 5% Iskra resistors 5 off each value 4·7Ω to 1MΩ. E12 pack 325 resistors **£2·40.** E24 pack 650 resistors **£4·70.**

POTENTIOMETERS

Carbon track 5kΩ to 2MΩ, log or linear (log ¼W, lin ½W). Single, **12p.** Dual gang (stereo), **40p.** Single D.P. switch **24p.**

SKELETON PRESET POTENTIOMETERS

Linear: 100, 250, 500Ω and decades to 5MΩ. Horizontal or vertical P.C. mounting (0·1 matrix).
Sub-miniature 0·1W, **5p** each. Miniature 0·25W, **6p** each.

TRANSISTORS

AC107	**15p**	BC107	**10p**	BF195	**15p**	OC81	**12p**	2N3703	**12p**
AC126	**12p**	BC108	**10p**	BFY50	**22p**	OC82D	**12p**	2N3704	**13p**
AC127	**12p**	BC109	**10p**	BFY51	**22p**	OCP71	**40p**	2N3705	**12p**
AC128	**12p**	BC147	**10p**	BFY52	**22p**	ORP12	**50p**	2N3706	**11p**
AC131	**12p**	BC148	**13p**	BSY56	**32p**	2N2369	**16p**	2N3707	**12p**
AC132	**12p**	BC149	**13p**	OC26	**45p**	2N2646	**60p**	2N3708	**10p**
AD140	**50p**	BC157	**13p**	OC28	**45p**	2N2926R	**9p**	2N3709	**11p**
AD161	**33p**	BC158	**13p**	OC35	**45p**	2N2926O	**9p**	2N3710	**11p**
AD162	**36p**	BC159	**13p**	OC42	**12p**	2N2926Y	**9p**	2N3711	**11p**
AF114	**20p**	BD131	**75p**	OC44	**12p**	2N2926G	**10p**	2N4062	**12p**
AF115	**20p**	BD132	**75p**	OC45	**12p**	2N3054	**58p**	ZTX302	**15p**
AF116	**20p**	BF179	**32p**	OC70	**12p**	2N3055	**60p**	ZTX500	**16p**
AF117	**20p**	BF181	**25p**	OC71	**12p**	2N3442	**140p**	ZTX503	**16p**
AF118	**38p**	BF194	**15p**	OC72	**12p**	2N3702	**13p**	40362	**58p**

ZENER DIODES

400mW 5% 3·3V to 30V, **15p.**

LINEAR IC's (DIL)

709	**50p**	741	**50p**
710	**50p**	748	**50p**

DIL SOCKET

14 and 16 pin **16p**

DIODES

RECTIFIER

BY127	1250V	1A	**12p**
BZY10	800V	6A	**25p**
BZY13	200V	6A	**20p**
IN4001	50V	1A	**7p**
IN4004	400V	1A	**8p**
IN4007	1000V	1A	**12p**

SIGNAL

OA85	**7p**
OA90	**5p**
OA91	**5p**
OA202	**7p**
IN4148	**5p**
BA114	**8p**

BRUSHED ALUMINIUM PANELS

12in x 6in=**25p**; 12in x 2½in=**10p**; 9in x 2in=**7p.**

SLIDER POTENTIOMETERS

86mm x 9mm x 16mm, length of track 59mm.
SINGLE 10K, 25K, 100K log. or lin. **40p.**
DUAL GANG, 10K + 10K etc. log. or lin. **60p.**
KNOB FOR ABOVE **12p.**
FRONT PANEL **65p**
18 Gauge panel 12" x 4" with slots cut for use with slider pots. Grey or matt black finish complete with fixings for 4 pots.

MULLARD POLYESTER CAPACITORS C296 SERIES

400V: 0·001μF, 0·0015μF, 0·0022μF, 0·0033μF, 0·0047μF, **2½p.** 0·0068μF, 0·01μF, 0·015μF, 0·022μF, 0·033μF, **3p.** 0·047μF, 0·068μF, 0·1μF, **4p.** 0·15μF, **6p.** 0·22μF, **7½p.** 0·33μF, **11p.** 0·47μF, **13p.**
160V: 0·01μF, 0·015μF, 0·022μF, 0·033μF, 0·047μF, 0·068μF, **3p.** 0·1μF **3½p.** 0·15μF, **4½p.** 0·22μF, **5p.** 0·33μF, **6p.** 0·47μF, **7½p.** 0·68μF, **11p.** 1·0μF, **13p.**

MULLARD POLYESTER CAPACITORS C280 SERIES

250V P.C. mounting: 0·01μF, 0·015μF, 0·022μF, **3p.** 0·033μF, 0·047μF, 0·068μF **3½p.** 0·1μF, **4p.** 0·15μF, 0·22μF, **5p.** 0·33μF, **6½p.** 0·47μF, **8½p.** 0·68μF, **11p.** 1·0μF, **13p** 1·5μF, **20p.** 2·2μF, **24p.**

MYLAR FILM CAPACITORS

100V, 0·001μF, 0·002μF, 0·005μF, 0·01μF, 0·02μF **2½p.** 0·04μF, 0·05μF, 0·068μF, 0·1μF, **3½p.**

CERAMIC DISC CAPACITORS

100pF to 10,000pF, **2p** each.

ELECTROLYTIC CAPACITORS—MULLARD C426 SERIES

6p each

(μF/V) 10/2·5, 40/2·5, 80/2·5, 160/2·5, 320/2·5, 500/2·5, 8/4,32 /4, 64/4, 125/4, 250/4, 400/4, 6·4/6·4, 25/6·4, 50/6·4, 100/6·4, 200/6·4, 320/6·4, 4/10, 16/10, 32/10, 64/10 125/10, 200/10, 2·5/16, 10/16, 20/16, 40/16, 80/16, 125/16, 1·6/25, 6·4/25, 12·5/25, 25/25, 50/25, 80/25, 1/40, 4/40, 8/40, 16/40, 32/40, 50/40, 0·64/64, 2·5/64, 5/64, 10/64 20/64, 32/64.

MULLARD C437 SERIES

100/40, 160/25, 250/16, 400/10, 640/6·4, 800/4, 1000/2·5, **9p.** 100/64, 160/40, 250/25, 400/16, 640/10, 1250/4, 1000/6·4, 1600/2·5, **12p.** 160/64, 250/40, 400/2·5, 640/16, 2000/4, 1000/10, 1600/6·4, 2500/2·5, **15p.** 250/64, 400/40, 640/25, 3200/4, 1000/16, 1600/10, 2500/6·4, 4000/2·5, **18p.**

ELECTROLYTIC CAPACITORS Miniature P.C. mounting

5p each.

(μF/V): 10/12, 50/12, 100/12, 200/12, 5/25, 10/25, 25/25, 100/25.

VEROBOARD

	0·1	0·15
2½ x 3¾	**22p**	**17p**
2½ x 5	**24p**	**21p**
3¾ x 3¾	**24p**	**21p**
3¾ x 5	**28p**	**28p**
17 x 2½	**75p**	**57p**
17 x 3¾	**100p**	**78p**
17 x 5 (plain)	—	**82p**
17 x 3¾ (plain)	—	**60p**
17 x 2½ (plain)	—	**42p**
2½ x 5 (plain)	—	**12p**
2½ x 3¾ (plain)	—	**11p**
Pin insertion tool	**52p**	**52p**
Spot face cutter	**42p**	**42p**
Pkt. 50 pins	**20p**	**20p**

JACK PLUGS AND SOCKETS

Standard screened	**18p**	2·5mm insulated	**8p**
Standard insulated	**12p**	3·5mm insulated	**8p**
Stereo screened	**35p**	3·5mm screened	**13p**
Standard socket	**15p**	2·5mm socket	**8p**
Stereo socket	**18p**	3·5mm socket	**8p**

D.I.N. PLUGS AND SOCKETS

2 pin, 3 pin, 5 pin 180°, 5 pin 240°, 6 pin
Plug 12p. Socket 8p.
4 way screened cable **15p**/metre
6 way screened cable **22p**/metre

BATTERY ELIMINATOR

£1·50

9V mains power supply. Same size as PP9 battery

THERMISTORS

VA1055S **15p** VA1066S **15p** VA1077 **15p** R53 **£1·35**

COMPACT CASSETTES—IN PLASTIC LIBRARY BOX

C90 **65p** C120 **85p**

LARGE (CAN) ELECTROLYTICS

1600μF	64V	**74p**	3200μF	16V	**50p**
2500μF	40V	**74p**	4500μF	16V	**50p**
2500μF	50V	**58p**	4500μF	25V	**£1·68**
2500μF	64V	**80p**	5000μF	50V	**£1·10**
2800μF	100V	**£3·00**			

HIGH VOLTAGE TUBULAR CAPACITORS—1,000 VOLT

0·01μF	**10p**	0·047μF	**13p**	0·22μF	**20p**
0·022μF	**12p**	0·1μF	**16p**	0·47μF	**22p**

POLYSTYRENE CAPACITORS 160V 2½%

10pF to 1,000pF E12 Series values **4p** each.

TAPE HEADS

We are gradually obtaining more information about the Truvox tape heads we have, we are told that these have been wound in a very ingenious way so that winding may be coupled either in parallel or in series depending whether high or low impedance is required. We also have matching erase heads and now offer these in pairs. 1 record and 1 erase head. Price of the 2 track **45p** per pair. 4 track **75p** per pair. Pair mounted on plate **45p** extra.

I R.P.M. MOTOR

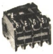
Made by the famous Smiths Company. 240v 50 cycle mains working. Ideal motor to drive clock mechanisms. Price **£1** each or 10 for **£9**.

DRILL CONTROLLER

NEW IKW MODEL

Electronically changes speed from approximately 10 revs. to maximum. Full power at all speeds by finger-tip control. Kit includes all parts, case, everything and full instructions. **£1·50** plus 13p post and insurance. Made up model also available. **£2·25** plus 13p post & p.

MAINS OPERATED CONTACTOR



220/240v. 50 cycle solenoid with laminated core so very silent in operation. Closes 4 circuits each rated at 10 amps. Extremely well made by a German Electrical Company. Overall size 2½ × 2 × 2in. **£1·50** each.

HIGH ACCURACY THERMOSTAT

Uses differential comparator I.C. with thermister as probe. Designer claims temperature control to within 1/7th of a degree. Complete kit with power pack **£5·50**.

AUTO—ELECTRIC CAR AERIAL

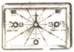
with dashboard control switch—fully extendable to 40in or fully retractable. Suitable for 12V positive or negative earth. Supplied complete with fitting instructions and ready wired dashboard switch. **£5·75** plus 25p post and insurance.

WATERPROOF HEATING ELEMENT

26 yards length 70W. Self-regulating temperature control. **50p** post free.

MULTI-SPEED MOTOR

Replacement in many well-known food mixers. Six speeds are available 500, 850 and 1,100 r.p.m. from either or both of the nylon sockets (where the beaters of the food mixer normally go) and 8,000, 12,000 and 15,000 r.p.m. (ideal polishing speeds) from the main drive shaft. This drive shaft is ¼ in. diameter and approximately 1 in. long. A further point about this motor is that being 230/240v. AC-DC series wound its speed may be further controlled with the use of our Thyrister controller. This is a very powerful and useful motor size approx. 2 in. dia. × 5 in. long, mains 230/240v. Price **88p** plus 23p postage and insurance, 12 or more post free.



15A ELECTRICAL PROGRAMMER

Learn in your sleep: Have radio playing and kettle boiling as you awake—switch on lights to ward off intruders—have warm house to come home to. All these and many other things you can do if you invest in an electrical programmer Clock by famous maker with 15 amp. on/off switch. Switch on time can be set anywhere to stay on up to 6 hours. Independent 60 minute memory jogger. A beautiful unit. Price **£1·95** + 20p p & p or with glass front chrome bezel **75p** extra.

0-8 AMMETER

2in square full vision for flush mounting. Moving iron instrument. Ideal for charger. Price **60p** each. 10 for **£5·40**.

NUMICATOR TUBES

For digital instruments, counters, timers, clocks, etc. Hi-vac XN. 3, Price **£1·45** each. 10 for **£13**.

12 WAY SUB-MINIATURE MULTI-CORE CABLE

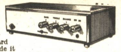
7·0076 copper cores each core P.V.C. insulated and of different colour. P.V.C. covered overall and approx. 3/16in. thick. Price **20p** per yard.

LIGHT CELL

Almost zero resistant in sunlight increases to 10 K Ohms in dark or dull light, epoxy resin sealed. Size approx. 1in. dia. by ½in. thick. Rated at 500 MW, wire ended. **43p** with circuit. Also ORP 12 light cell **45p**.

MULLARD 4 + 4

STEREO AMPLIFIER



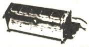
We demonstrate these daily and almost always a sale results; it really is a cracking amplifier. Only Mullard with their know how could have made it possible at this low price. SPEC.: Mains operated; 4 watts music or speech per channel; Double wired power supply eliminates cross talk. Harmonic distortion less than 2%. Frequency response 50hz–16Khz. Input suitable for pick up tuner or microphone. 6 month guarantee. Only **£9·95** + 30p postage and insurance.

THYRISTOR LIGHT DIMMER

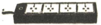
For any lamp up to 200 watt. Mounted on switch plate to fit in place of standard switch. Virtually no radio interferences. Price **£2·50** plus 20p post and insurance.

TANGENTIAL HEATER UNITS

This heater unit is the very latest type, most efficient, and quiet running. Is as fitted in Hoover and blower heaters costing £15 and more. We have a few only. Comprises motor, impeller, 2kW. element and 1kW. element allowing switching 1, 2 and 3kW. and with thermal safety cut-out. Can be fitted into any metal line case or cabinet. Only need control switch. **£3·50.** 2kW. Model as above except 2 kilowatts **£2·50.** Don't miss this. Control Switch **35p**. P. & P. 40p.



DISTRIBUTION PANELS



Just what you need for work bench or lab. 4 × 13 amp sockets in metal box to take standard 13 amp fused plugs and on/off switch with neon warning light. Supplied complete with 6 feet of flex cable. Wired up ready to work. **£2·25** plus 23p P. & I

THIS MONTH'S SNIP

A bargain parcel of 7 motors for £1. Some not as large as a postage stamp and only ⅜″ thick, largest is 1½″ × 1¼″ dia. Some work off 1½v some as high as 18v. These motors are used in racing cars, power toys etc. The largest is so powerful that it will drive a Mini drill, model lathe, or similar. This is a 4 pole motor, optimum working 16·5v but very powerful even as low as 4½v. Don't miss this wonderful snip.

REPEATING TIME SWITCH

1 or 2 on/offs per 24 hours. Repeats until re-programmed. Switches up to 15 amp. Switching time completely adjustable through 24 hours. Precision made with 24 hour dial. Miniature—will fit into 2ins cube. Mains operated clock but switch may be isolated for switching battery sets. Ideal for shop window lighting, anti-thief devices, central heating control and many other automatic processes. Price with instructions **£2** each plus 20p post and insurance.

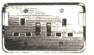
STANDARD WAFER SWITCHES

Standard size 1½″ wafer—silver-plated 5-amp contact, standard ¼″ spindle 2″ long—with locking washer and nut.

No. of Poles	2 way	3 way	4 way	5 way	6 way	8 way	9 way	10way	12way
1 pole	40p	40p	40p	40p	40p	40p	40p	40p	40p
2 poles	40p	40p	40p	40p	40p	40p	40p	70p	70p
3 poles	40p	40p	40p	40p	70p	70p	70p	95p	95p
4 poles	40p	40p	40p	70p	70p	70p	70p	£1·20	£1·20
5 poles	40p	40p	70p	70p	95p	95p	95p	£1·45	£1·45
6 poles	40p	70p	70p	70p	95p	95p	95p	£1·70	£1·70
7 poles	70p	70p	70p	95p	£1·20	£1·20	£1·20	£1·95	£1·95
8 poles	70p	70p	70p	95p	£1·20	£1·20	£1·20	£2·20	£2·20
9 poles	70p	70p	95p	95p	£1·45	£1·45	£1·45	£2·45	£2·45
10 poles	70p	70p	95p	£1·20	£1·45	£1·45	£1·45	£2·70	£2·70
11 poles	70p	95p	95p	£1·20	£1·70	£1·70	£1·70	£2·95	£2·95
12 poles	70p	95p	95p	£1·20	£1·70	£1·70	£1·70	£3·20	£3·20

MULLARD AUDIO AMPLIFIER MODULE

Uses 4 transistors, and has an output of 500mW into 8 ohms speakers. Input suitable for crystal mic. or pick-up. 9 volt battery operated. Size 2″ long × 1¼″ wide × 1″ high. SPECIAL SNIP PRICE **60p** each. 20 for **£5·40**



13 AMP TWIN GANG SOCKETS

Offered at less than wholesale price your opportunity to replace those dangerous adaptors—brown bakelite flush mounting—standard fitting. Unswitched **20p** each, separately switched **30p** each. Separately switched and with neon on/off indicators **45p** each. Less 10% ten or more +20p postage if order under £5.

50 MICRO AMMETER

Square, panel mounting type. **£2**

INTEGRATED CIRCUIT BARGAIN

A parcel of integrated circuits made by the famous Plessey Company. A once-in-a-lifetime offer of Micro-electronic devices well below cost of manufacture. The parcel contains 5 ICs all new and perfect, first-grade device, definitely not sub-standard or seconds. 4 of the ICs are single silicon chip GP amplifiers. The 5th is a monolithic NPN matched pair. Regular price of parcel well over £5. Full circuit details of the ICs are included and in addition you will receive a list of many different ICs available at bargain prices **25p** upwards with circuits and technical data of each. Complete parcel only **£1** post paid.

DON'T MISS THIS TERRIFIC BARGAIN.

MULLARD I.F. MODULE

This is a fully screened intermediate frequency module for amplification and detection of f.m. signals at 10·7MHz and a.m. signals at 470kHz. The first stage is used as an i.f. amplifier for f.m. and a self-oscillating mixer for a.m. operation, in conjunction with an external oscillator coil. **75p** each. 10 for **£6·75**. 100 for **£62·50p**. With connection dig.

MINIATURE WAFER SWITCHES

2 pole, 2 way—4 pole, 2 way—3 pole, 3 way—4 pole, 3 way—2 pole, 4 way—3 pole, 4 way—2 pole 6 way—1 pole, 12 way. All at **20p** each, **£1·80** for ten, your assortment.

TOGGLE SWITCH

3 amp. 250v. with fixing ring **7½p** each, **75p** doz.

ROCKER SWITCHES

Three new types to offer this month all snap-in fixing into oblong holes.

Type 1. S.P. on/off 10 amp. 250V. Size approx. 1⅛″ × ⅝″. Made by Arrow Electric. (93 series.) Price **12p** each; 10 for **£1·08**.

Type 2. D.P. on/off 10 amp. 250V with neon indicator in the lever. Again Arrow 93 series. Price **25p** each or 10 for **£2·25**.

SLIDE SWITCH

2 pole change over panel mounting by two 6 BA screws. Size approx. 1″ × ⅜″ rated 250v lamp **6p** each, 10 for **54p**. 100 for **£5·10**, 500 for **£24**.

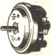
MICRO SWITCH

5 amp changeover contacts, **9p** each, **£1** doz. 15 amp Model **10p** each or **£1·05** doz.

NEED A SPECIAL SWITCH?

Double Leaf Contact. Very slight pressure closes both contacts. **6p** each, **60p** doz. Plastic push-rod suitable for operating, **5p** each, **45p** doz.

PRESSURE SWITCH



Containing a 15 amp. change over switch operated by a diaphragm which in turn is operated by air pressure through a small metal tube. The operating pressure is adjustable but is set to operate in approx. 10 in. of water. These are quite low pressure devices and can in fact be operated simply by blowing into the inlet tube. Original use was for washing machines to turn off water when tub has reached correct level but no doubt has many other applications.

75p each. 10 for **£6·75**.

SWITCHES ???

We could fill this whole page with all the switches we have so if you can't see the one you want send for our switch list.

TIMED "ON" SWITCHES. Made by Smiths for washing machines, etc. Centre spindle closes double pole 15 amp switch directly it is turned. A full 360° turn or only a part turn winds the clockwork mechanism and keeps the switch closed until the spindle returns to the "off" position. A dial therefore could be fitted to indicate hours and minutes and the switch on period could be set quite accurately. 3 models available—90 minutes, 120 minutes and 360 minutes. Price **95p** each. Metal clad pointer knob **15p**. Suitable relay to make the switch "on" instead of "off" **35p**.

LEVER SWITCH—Ref. H52/4. Ideal for intercom or similar. Pressing the lever down operates 6 pairs of change-over contacts, pressing the lever up operates 4 pairs of change-over contacts. The switch is spring loaded and normally returns to the off or centre position. Size approximately 1½″ long × 2½″ deep × ½″ thick. **40p** each.

5 PUSH BUTTON SWITCHES. Mains, suitable for audio or R.F. Each switch rated at 250v. 15 amps. 1st (black push button) closes 2 circuits. 2nd (white push button) operates one change-over. 3rd (white push button) operates one change-over. 4th (white push button) opens one circuit. Note: all depressed buttons remain down until cleared by the 5th (red button). Further note: It is a relatively easy job to alter the position of the tags thus making the switches suit your circuit. Fitted with 3 white, 1 red and 1 black button. **30p** each or 10 for **£2·70**.

PUSH OPERATED MICROSWITCH. Change-over contacts, spring return when plunger released. Also fitted with lamp holder to take Lilliput lamp in plunger; fixing is by locknut, through ⅜″ hole. Price **25p** each or 10 for **£2·25**.

22-POSITION SOLENOID OPERATED STUD SWITCH. Mains operated, each current pulse to switch solenoid moves switch arm through one position on to the next contact stud—current to release solenoid brings back switch arm to position one. These are ex-equipment but in good working order. Any not so would be replaced. Price **50p** each.

Where postage is not stated then orders over £5 are post free. Below £5 add 20p Semiconductors add 5p post. Over £1 post free. S.A.E. with enquiries please.

J. BULL (ELECTRICAL) LTD.

(Dept. E.E.), 7 Park Street, Croydon CRO IYD

Callers to: 102/3 Tamworth Road, Croydon.

Published approximately the third Friday of each month by IPC Magazines Ltd., Fleetway House, Farringdon Street, London, E.C.4A 4AD. Printed in England by Index Printers Ltd., Dunstable, Beds. Sole Agents for Australia and New Zealand—Gordon & Gotch (A/Sia) Ltd. South Africa—Central News Agency Ltd.: Rhodesia and Zambia—Kingstons Ltd.: East Africa—Stationery and Office Supplies Ltd. Subscription Rate (including postage): For one year to any part of the world £2·35. Everyday Electronics is sold subject to the following conditions, namely that it shall not, without the written consent of the Publishers first given, be lent, resold, hired out or otherwise disposed of by way of Trade at more than the recommended selling price shown on the cover, and that it shall not be lent, resold or hired out or otherwise disposed of in a mutilated condition or in any unauthorised cover by way of Trade, or affixed to or as part of any publication or advertising, literary or pictorial matter whatsoever.

ADCOLA

meet the precision 'INVADER' SOLDERING INSTRUMENTS

Precision instruments supplied with standard detachable copper chisel face bits. Standard temp. 360°C at 19/23/27 watts. Special temps. from 250°C/410°C.

For perfection in soldering

L1076
BIT SIZE 1/4"
6.34 mm Dia.
27 watts.
£2·18

L646
BIT SIZE 3/16"
4.75 mm Dia.
23 watts.
£2·12

L706 →
BIT SIZE 1/8"
3.2 mm Dia.
19 watts.
£1·96

as selected for the DESIGN CENTRE LONDON

Don't take chances. We don't. All our ADCOLA Instruments are of impeccable quality. You can depend on ADCOLA day after day. That's why they're so popular. You get good service ... reliability... from our famous thermally controlled ADCOLA Element and the tough steel construction of this production tool. ADCOLA day after day.

Send for NEW catalogue today

ADCOLA PRODUCTS LTD. ADCOLA HOUSE GAUDEN ROAD LONDON, SW4 6LH
Postage, packing paid on orders over £2. under £2. add £0·10

Models required ______________________________

Enclosing P/O or cheque for ______________________________

Name

Address

EE5

Are you alright for Jacks?

Ask for Rendar Jack plugs and sockets at your local stockist. They come in a wide variety of configurations, and in cases of difficulty can be ordered DIRECT from the Rendar factory.

Standard, mini and sub-miniature sizes ... plugs in both screened and unscreened versions ... socket bodies in high melting point thermoplastic ... several unique features (some protected by UK and US Patents) ... Post Office and NATO specifications.

If you want to study all the facts and figures, all the ingenious construction details, send for the Rendar Electronic Components Catalogue of technical data sheets covering their entire range of products.

The cost of the catalogue is 25p, including P & P, and it's money very well spent!

COMPONENTS FOR LAND, SEA & AIR

RENDAR®

Rendar Instruments Ltd., Victoria Road
Burgess Hill, Sussex. Tel. Burgess Hill 2642-4
Cables: Rendar, Burgess Hill

SOUND BARGAINS

GIANT POWER MULTI-WAVEBAND COMMUNICATIONS RECEIVER

WITH 3 in 1 AC/DC POWER SUPPLY SYSTEM
MAINS/BATTERY plus BUILT-IN BATTERY BOOSTER

BEST OF ALL WORLDS

VHF, FM, AM, AFC, AIR BAND, PUBLIC SERVICE AND WEATHER BANDS

BATTERY CHECK INDICATOR

OUR PRICE £10·50 +40p P. & P.

THIS NEW 1972 RADIO. No less than **3 VHF BANDS.** Picks up **Aircraft Transmissions, Pop Pirates, Taxis, Ambulances, Local Radio, Continental and all BBC, VHF Stations plus fascinating Public Service Transmissions we are not allowed to mention! Even TV sound in certain areas. PLUS A SPECIAL WEATHER-BAND.** Frequency ranges: MW540–1600 KHZ, FM88–108MHZ, Airband 108–145 MHZ, VHF 145–175MHZ, 23 semi-conductors—12 transistors, 11 diodes and thermistors. Automatic frequency control. 31" telescopic aerial. Runs off mains AC 230/250 volts or off 4 U11 batteries, or use re-chargeable nickel alkali cell. Finished in strong leather grained case with carrying handle. Approx. size 10¾" × 6⅝" × 3¾": Written guarantee. **Special magnetic ear-piece for personal listening, dry batteries FREE. HURRY!** Limited quantity only from Marktyme. **Fully guaranteed.**

OUR PRICE £28·95 +50p P. & P.

8 WAVEBANDS AND WORLD MAP & TIME ZONE DIAL

Tune into the world with this amazing communications receiver. A truly exceptional unit in performance and looks—leatherette with stainless steel trim. Looks good anywhere. Use either as a portable with standard batteries or plug it directly into 220–240 volt domestic mains supply. 14 Transistors; 9 diodes; 1 thermistor. Internal ferrite rod antenna plus telescopic aerial. Separate tone, volume and tuning controls with push-button selectors for the **8 WAVEBANDS.** Complete with Hi-Fi earphone for personal listening. Frequency ranges: **Long wave** 150–350Kcs. **Medium** 353–1605Kcs. **Marine** 1·6–4·5Mcs. **Short Wave** 12–24Mcs. **FM/VHF** 88–108Mcs. **Aircraft** 108–135 Mcs. **PUBLIC SERVICE BANDS** 135–174Mcs. Fully guaranteed.

N.B.—The Ministry of Post & Telecommunications has pointed out that a licence (not generally available to the public) is required for reception of transmissions by Fire Brigade, Aircraft, Shipping, etc.

MARKTYME

(Dept. ED6), 372 EDGWARE ROAD,
LONDON, W.2. Tel. 01-723 0094.
Callers welcome Monday to Saturday
9 a.m.–6 p.m.

U.K's LARGEST ELECTRONICS CENTRES!

HENRY'S RADIO LTD. EDGWARE ROAD, LONDON, W.2.

NOW OPEN!

404-406 ELECTRONIC COMPONENTS & EQUIPMENT 01-402 8381
354-356 HIGH FIDELITY & TAPE EQUIPMENT 01-402 5854/4736
309 PA - DISCO - LIGHTING HIGH POWER SOUND 01-723 6963
303 BARGAIN STORE SPECIAL OFFERS All Mail to: 303, Edgware Rd., London, W2 1BW

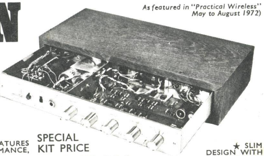
ALL YOUR ELECTRONIC REQUIREMENTS WITHIN 200 YARDS. CALL IN AND SEE FOR YOURSELF.

BUILD THE TEXAN

As featured in "Practical Wireless" May to August 1972)

20 + 20 WATT INTEGRATED I.C. STEREO AMPLIFIER

★ **FREE TEAK CABINET** with complete kits!



FEATURES. New slim design with 6 - IC's, IC Sockets, 10 silicon transistors, 4 rectifiers, 2 zeners. special Gardeners low field slim line transformer. Fibre glass PC panel. Complete chassis work.

HIGH QUALITY & STABILITY ARE PREDOMINATE FEATURES —DEVELOPED BY TEXAS ENGINEERS FOR PERFORMANCE, RELIABILITY AND EASE OF CONSTRUCTION.

FACILITIES. On/off switch indicator, headphone socket, separate treble, bass, volume and balance controls, scratch and rumble filters, mono/stereo switch, Input selector; Mag. P.U. Radio Tuner, Aux. Can be altered for Mic., Tape, Tape-head, etc (Parts list Ref. 20 on request).

SPECIAL KIT PRICE **£28·50** P & P 45p

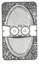
★ SLIM DESIGN WITH SILVER TRIM
Overall chassis size 14½" x 6" x 2" high

COMPLETE WITH FREE TEAK CABINET
Designer approved kits only available from Henry's

LOW COST HI-FI SPEAKERS

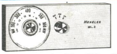
E.M.I. Size 13½" × 8½". Large Ceramic Magnet.

- **TYPE 150** 6 watt, 3, 8 or 15 ohms **£2·20.** Post 22p.
- **TYPE 150 TC** Twin cone version **£2·75.** Post 22p.
- **TYPE 450** 10 watt with twin tweeters and crossover. 3, 8 or 15 ohms. **£3·85.** Post 25p.
- **TYPE 350** 20 watt with tweeter and crossover. 8 and 15 ohms. **£7·70:** Post 28p.



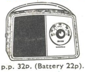
POLISHED CABINETS 150, 150TC 450 **£4·60.** Post 30p.

ML-3 MW/LW TUNER to BUILD



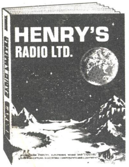
Uses Mullard Module. Slow motion tuning. Built in battery. Ferrite aerial. Overall size 7" × 2¾" × 3⅞". TOTAL COST TO BUILD £4·85, Post 15p. All parts sold separately. Leaflet No. 6

"BANDSPREAD" PORTABLE TO BUILD



Printed circuit all transistor design using Mullard RF/IF Module. Medium and Long Wave bands plus Medium Wave Bandspread for extra selectivity. Also slow motion geared tuning, 600 mW push-pull output, fibre glass PVC covered cabinet, car aerial. Attractive appearance and performance. TOTAL COST TO BUILD **£7·98,** p.p. 32p. (Battery 22p). All parts sold separately—Leaflet No. 2

CATALOGUE



Fully detailed and illustrated covering every aspect of Electronics—plus data, circuits and information. 10,000 Stock lines at Special Low Prices and Fully Guaranteed.

PRICE **55p** Post Paid
(40p FOR CALLERS)

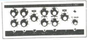
PLUS! FIVE 10p VOUCHERS

Send to this address—
HENRY'S RADIO LTD.
(Dept. EE) 3 ALBEMARLE WAY, LONDON, E.C.1.—
for catalogue by post only. All other mail and callers to "303" see below.

TEST EQUIPMENT

SE250B	Pocket Pencil Signal Injector **£1·90**
SE500	Pocket Pencil Signal Tracer **£1·50**
TE15	Grid Dip Meter 440 KHz–280 mHz **£13·45**
500	30 K/V Multimeter **£9·25** With leather case **£10·50**
200H	20K/V Multimeter **£4·20.** With case **£4·95**
AF105	50K/V Multimeter **£8·50.** With case **£9·50**
U4341	AC/DC Multimeter with transistor tester with steel case **£10·50**
TE20D	RF Generator 120KHz–500MHz **£15·95.** Carr. 35p
TE22D	Audio Generator 20Hz–200KHz **£17·50.** Carr. 35p
TO3	3" Scope 1½Hz–1½MHz **£39·00.** Carr. 50p
CI-5	3" Pulse Scope 10Hz–10mHz **£39·00.** Carr. 50p
TE65	Valve Voltmeter 28 ranges **£17·50.** Carr. 40p

PA-Disco-Lighting



UK's Largest Range—Write phone or call in. Details and demonstrations on request.

DJ30L	3 Channel sound to light unit, 3kw **£28·50**
DJ40L	3 Channel Mic (Built in) to light, 3kw **£37·50**
DJ70S	70 watt Disco amp/mixer **£49·75**
DISCOAMP	100 watt Disco amp/mixer **£67·50**
DJ105S	30 watt Disco amp/mixer **£31·00**

Anti-Feedback Quality Mic. **£11·50**
SDL 12" 50 watt 8 ohm Full range speaker **£12·95**
DECKS. Use MP60 or SP25/3 see above
Matching cartridge SC5M **£2·62**

FIBRE OPTICS, LIGHTING EFFECTS, PROJECTORS, SPOTS, DIMMERS, MIXERS. Everything for PA—Disco—Lighting. FREE Stock List Ref. No. 18.

BUILD THIS VHF FM TUNER

5 TRANSISTORS 300 kc/s BANDWIDTH, PRINTED CIRCUIT, HIGH FIDELITY REPRODUCTION. MONO AND STEREO

A popular VHF FM Tuner for quality and reception of mono and stereo. There is no doubt about it—VHF FM gives the REAL sound. All parts sold separately. Free Leaflet No. 3 & 7.

TOTAL £6·97, p.p. 20p. Decoder Kit **£5·97.**
Tuning meter unit **£1·75**
Mains unit (optional) Model PS900 **£2·47.** Post 20p
Mains unit for Tuner and Decoder PS6/2 **£3·25.** Post 20p

SINCLAIR PROJECT 60 MODULES —SAVE POUNDS!

Z30 **£3·57;** Z50 **£4·37**
STEREO 60 **£7·97;** PZ5 **£3·97**
PZ8 **£4·77**
PZ6 **£6·37;**

Transformer for PZ8 **£2·95**
Active Filter Unit **£4·45**
Stereo FM Tuner **£16·95**
IC12 **£1·80;** Q16's **£15** pr.
Post etc. 20p per item

PACKAGE DEALS Post 25p

2xZ30, Stereo 60, PZ5	**£15·95**
2xZ30, Stereo 60, PZ6	**£18·00**
2xZ50, Stereo 60, PZ8	**£20·25**
Transformer for PZ8	**£2·95**
PROJECT 605 KIT	**£19·95**

RECORD DECKS

CHASSIS (Post 50p)

SP25/3	**£10·75**	HT70	**£15·00**
MP60	**£10·40**	MP610	**£14·15**
AP76	**£18·95**	GL72	**£22·25**

WITH PLINTH/COVER (Post 70p)

MP60	**£17·20**	TD150AB	**£41·45**
HT70	**£21·60**		
HL(GL75)	**£35·25**	PL12AC	**£35·25**
MP610	**£20·35**	BD2	**£32·25**

CART/PLINTH/COVER (Post 70p)

(HL) AP76/G800/PC	**£29·95**
(HL) SP25-3/G800H/PC	**£18·95**
HT70/G800/PC	**£27·00**
(HL) 2025TC/9TAHCD/PC	**£13·50**
MP60/SC5MD/PC	**£17·25**
(HL) GL75/G800E/PC	**£44·15**
(HL) GL72/800/PC	**£35·50**

ULTRASONIC TRANSDUCERS

Operate at 40kc/s up to 100 yds. Ideal remote switching and signalling. Complete with data and circuits. **£5·90** per pair. Post 10p

MARRIOT TAPE HEADS 4 TRACK MONO or 2 TRACK STEREO

'17' High Impedance	**£2·00**
'18' Med. Impedance	**£2·00**
'36' Med.-Low Imp.	**£3·50**
Erase Heads for above	**75p**
'63' 2 track mono–Hi Imp.	**£1·75**
'43' Erase Head for above	**75p**

POWER INTEGRATED CIRCUITS

Plessey SL403D—3 watt with 8-page data, layouts and circuits **£1·50.** P.C. Board **60p.** Heat Sink **14p.**
Sinclair IC12—6 watt with data and circuits **£1·80.**
TH9013P—20 watt Power Amp Module **£4·57.**
TH9014P–IC Preamp **£1·50.**
Data/Circuits for above No. 42 **10p**

7 SEG & NIXIE TUBES

(Post 15p per 1 to 6)

XN3, XN13, GN6 0–9 side view with data, **85p.**
GNP-7, GNP-8 0–9 side view with decimal points and data, **95p.**
3015F 7 seg **£2 each. £7** per 4 with data.
12 and 24 hour clock circuits for above Ref, No. 31 **15p.**

Miniature Amplifier

5 transistor. 300mW o/p. Fitted volume and sensitivity control, 9 volt operated. **£1·75** each P/P 15p.

Quality Slider Controls

60mm stroke singles and ganged. Complete with knobs. 5K, 10K, 25K, 100K, 500K. 1 meg, Log and Lin. **40p each,** 10K, 25K, 50K, 100K, Log and Lin ganged. **60p** each.

Hi-Fi & Tape Equipment

Acknowledged as U.K.'s Largest Stockists with Lowest Prices Plus 12 months Guarantee. Write or call for FREE 16 page lists (Ref. 16/17)

Transistors - IC's - SCR'S - Rectifiers - Triacs, etc.
NEW FREE LISTS
Ref. No. 36 on request.

MORE OF EVERYTHING AT LOW PRICES ALWAYS AT HENRY'S

All the parts you need plus Data and Circuits — Get a Catalogue — it's all in there!

Prices subject to change without notice E. & O.E.

309-354-356-404-406 Open 6 days a week 9am - 6pm (303 closed Thurs.) All Stores open all day Saturday.

H MORE OF EVERYTHING AT THE RIGHT PRICE ALWAYS AT HENRY'S H